MUNICIPAL ENGINEERING

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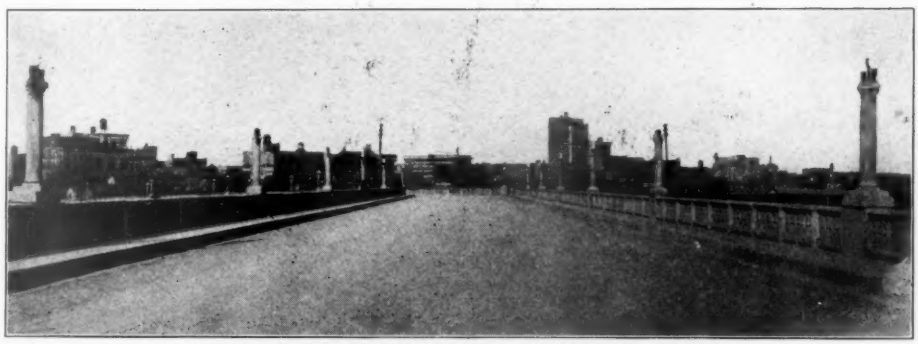

DALLAS CONCRETE VIADUCT AND ORNAMENTAL LAMPS.

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"There is nothing which so interests anyone as the occupation by which he earns a living. If one can show a man that, if he does this or that, he will be a more efficient worker and will earn a larger income from his labor, it will have a direct interest for him that no urging, which he may get in the general school to acquire abstract information or knowledge, will ever have."

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CHARACTERISTIC STREET

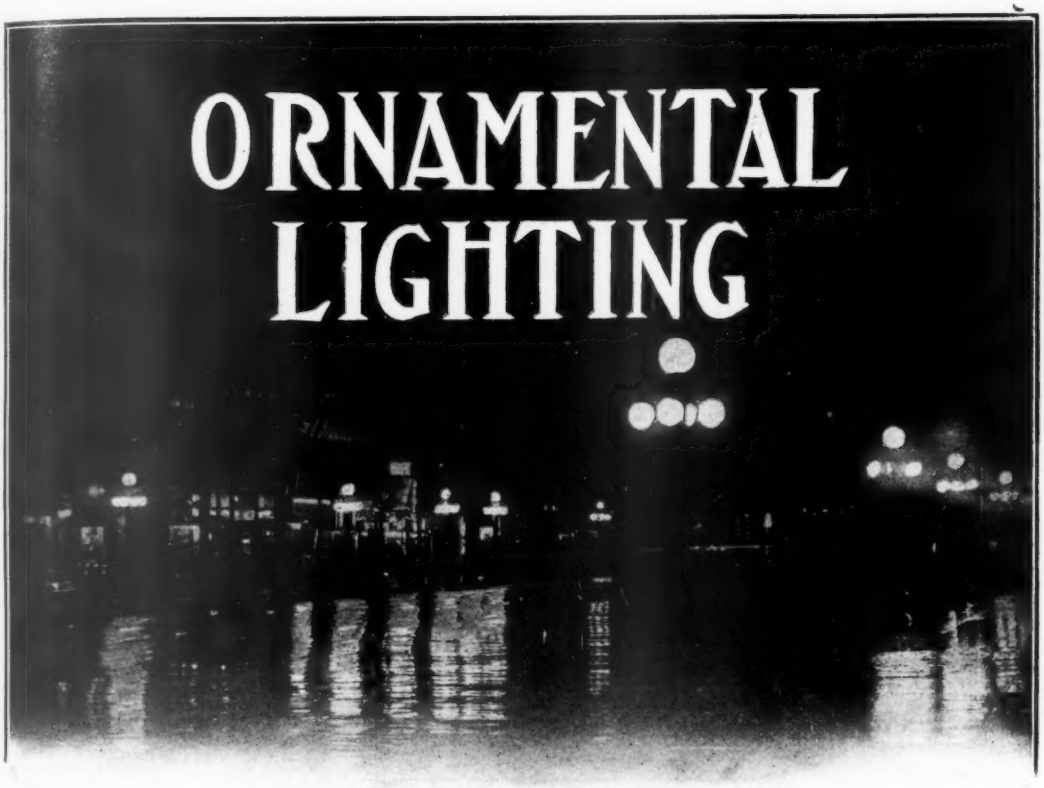
IT is generally conceded that there is no public improvement of which the benefits are more evident and far-reaching than the installation of ornamental or decorative street lighting. Radical changes in the types of illuminants used for lighting public highways are taking place and are likely to continue for some time. Almost every city in the country has removed the old-fashioned arcs on at least two or three of the most important streets and has installed the more attractive and more efficient types of lighting. It is estimated that no less than five hundred cities have now adopted the "low lighting" system. While the majority of these new installations seem to be centered in Ohio, Indiana, Illinois and Michigan, a great many cities of the progressive West and South have "white ways" to illuminate prominent thoroughfares that have heretofore been in semi-darkness.

When first introduced, the ornamental system was looked upon as an expensive luxury that would probably be used only for small installations put in privately by individuals, or for the exterior lighting of public buildings. The idea that this form of outdoor lighting would be adopted generally to light the entire business sections of many cities was not appreciated at that time. The first installations were costly. The use of heavy cast iron posts and expensive underground conduit construction made the system almost prohibitive. However, the introduction of standards of lighter design and the perfection of a well-insulated, lead-covered, steel-taped cable for underground use without conduit has brought the cost of ornamental lighting within the reach of any community.

Interesting Ball Globe Installations

A great deal of local interest is often aroused in working up a new street light-

Much of the information and a number of photographs contained in this article were furnished by Alan Bright, Pittsburgh, Pa.



ing system. It is only natural that every city should try to make its posts suggest local manufacture or embody some particular feature that is characteristic of the locality. A very unusual and unique installation is that in Bloomington, Ind. This city has erected 120 posts that are cut from native limestone. The posts are inexpensive and handsome, and represent one of the chief industries of the city. The system not only attracts local trade for the merchants on the main streets and pleases the public in general of that city, but furnishes an excellent advertisement for the city itself.

St. Paul, Minn., has a fine installation of ornamental lights. The posts are of attractive design, and support five lights, one erect and four pendant Alba ball globes, with tungsten lamps. There are about 300 of these in the downtown section. But St. Paul is not satisfied with "letting well enough alone," for a permanent installation of festoon lighting is provided for special occasions, holidays, etc. The festoons extend from a central circle of lamps, by a series of loops to the posts on either side of the street. The circle is especially intended for displaying an emblem or device suggestive of any special festivity for which the illumination may be provided.

Another interesting example of unusual ornamental lighting may be seen in Riverside, Cal. The top of the post resembles the Greek letter "Pi" standing upright on a plain cross-arm. From the center of the top and from either extremity of the cross-arm are suspended tungsten lamps, inclosed in shades that are designed to resemble in shape the old mission bells of the city.

There is hardly a traveler that has not at some time had his attention called to the beautiful lighting of the Michigan boulevard in Chicago. This system was put in some time ago, and is an excellent example of the amount of advertising a city may derive from a well-lighted highway. Each ornamental standard supports

ORNAMENTAL LIGHTING.
Night View of Ball Globe Lighting on Michigan Ave., Chicago.

six 60-watt tungsten lamps inclosed in ball globes. At intervals single light standards equipped with red globes are placed in the center of the boulevard to act as "channel markers" for all traffic.

One of the most prominent of recent installations is the new system of lighting the famous board walk in Atlantic City, N. J. This well-known promenade was formerly lighted with arc lamps on tall standards and festoons of incandescent lamps. The festoons did little to actually illuminate the board walk, and gave it a temporary, undignified appearance. Not only the business and hotel men of Atlantic City, but many of the regular visitors urged the adoption of a modern system of lighting. The city officials who were familiar with the success of the cluster system in other cities and appreciated its advantages, only awaited public support. Ornamental standards of rather unique design were adopted. Each post supports four 60-watt lamps and one 100-watt lamp inclosed in Alba ball globes. The top globe is raised some distance above the four pendant globes—an arrangement unlike that in any other city. There are 302 standards, spaced at 65 feet apart. The new system covers a distance of two miles—from the million-dollar pier, at the lower end of the busy part of Atlantic City, to the inlet.

ORNAMENTAL LIGHTING.
Adaption of Globe to Location of Police and Fire Alarm Boxes.

Three-wire 110-220-volt alternating current is used. The switch control boxes are located at alternate street intersections, so that each switch turns on and off two blocks of standards, one in either direction. The standards cost approximately $90 each. The "under the board walk" distribution system cost approximately $50 per standard. This cost is considerably higher than would be expected, as one would suppose that a system where no underground construction is necessary would cost appreciably less than one where the distributing wires are placed beneath expensive pavements in steel and lead-protected, insulated cable costing 25 cents per foot or more. However, the extreme atmospheric conditions at Atlantic City have caused the distribution system to compare in cost to that of underground systems in other cities.

Residential Ornamental Lighting

Ornamental street lighting is generally confined to business streets or to boulevards and parks, where plenty of traffic warrants the installation of elaborate concrete or metal standards and expensive underground construction. In residence districts where streets are comparatively little used, old types of arc, incandescent and oil lamps are frequently seen. Quite often attempts have been made to devise some sort of ornamental unit for use in rural districts, but in most cases the excessive cost will not warrant an installation. However, in Toronto, Ontario, the residents of Charles street have adopted a system of lighting that is not only attractive and efficient, but very inexpensive. On light wooden poles set inside the sidewalks are mounted cast iron lantern-like brackets holding an 8x8-inch cylinder of glass that incloses a 150-watt tungsten lamp. The system produces an illumination quite ample for residential streets, with all the novel and decorative effects of an ornamental system. Some of the Pacific coast cities have adopted this system for lighting streets in rural districts.

ORNAMENTAL LIGHTING.
Luminous Arc Lights in Baltimore, Md.

Special Features of Ornamental Lighting

One of the many advantages of the ornamental system of street lighting is its adaptability for service in police and fire alarm systems. Formerly it was the custom in many cities to paint the telegraph pole nearest the fire alarm box red, so that in case of fire one could easily locate the alarm box. For the same purpose the police patrol boxes were painted green. This scheme serves its purpose in daylight, but after nightfall the location of the alarm boxes is no longer visible. What is needed is a system that will indicate instantly the exact location of the alarm box, both at night and in the daytime. As a means to accomplish this result some cities have inclosed the top light of the ornamental street lighting standard nearest the alarm box in a globe, upon which a 6-inch colored band has been burned. On this band may appear suitable lettering. The letters show white thru the colored band. Some cities make use of a colored band on the top globe on street lighting standards to mark railroad crossings.

ORNAMENTAL LIGHTING.
Day View of Grand River Avenue, Detroit, Showing Four Light Standards Closely Placed on a Narrow Street.

In Fort Worth, Tex., "fire alarm" and "police alarm" globes are used on the street lighting standards. In connection with the "police alarm" posts the city has an elaborate system of signaling. Any police officer on duty may be summoned by flashing any particular signal light in his locality. At the present time several of the Pacific coast cities are considering the adoption of signal systems in connection with their ornamental lighting systems.

The Downward Reflecting Type of Unit

Similar in many respects to the ball globe type of street lighting unit, and yet differing in some principles, is the downward reflecting type of light. It is also an incandescent system, with the lamps and shades supported by ornamental poles, and consists of two, three, four or five lamps, as desired. It is the contention of the manufacturers of this system that the light should not be distributed evenly in all directions, but that it is needed at the street surface, and the maximum light should therefore be directed downward at an angle of 60 degrees, with little light thrown to the side or upward. This effect is secured by using a glass reflector so designed as to direct downward within a given angle the light, the source of which is a tungsten lamp suspended at the center of the reflector. Surrounding the reflector and rigidly attached to it is an opalescent envelope or shade of attractive design. A great deal of attention is directed in this system toward securing the proper spacing of units, so that the circle of light from each unit overlaps at the surface of the street with the circles from the units on each side. In this way

ORNAMENTAL LIGHTING.
Night View of Grand River Avenue, Detroit, Showing Effect of Gas Lighting.

the shadows midway between the standards are avoided.

Newark, O., was the first to adopt this style of street lighting, while Cincinnati, O., after a campaign conducted by the Business Men's Club of that city, was the next to install the downward reflecting unit. A full description of the Cincinnati system was given in the March, 1911, MUNICIPAL ENGINEERING.

The Gas White Way

The most notable installation of a gas "White Way" lighting system is that of Detroit, Mich. This installation was made possible by the organization of a "boosters" club known as the Grand River Avenue Improvement Association, working in conjunction with the Detroit Board of Commerce. Grand River avenue is not a main street, and the system is unique in this respect, as it is somewhat unusual, because it was constructed and maintained by property owners along the street, the tenants paying the maintenance. It is stated that the system has transformed the avenue of secondary importance to one of the progressive shopping districts of the city.

The installation consists of forty-two four-light posts set opposite each other, eight posts to the block of 200 feet, and eighty two-light posts staggered at an average of 125 feet apart on each side of the street. All the lamps are of the three-mantle inverted gas arc design, with side supply, giving from 300 to 350 candle power per standard.

The lamps are fitted with alabaster glassware and hung 12 feet from the street. This gives a very brilliant illumination without dazzle or glare, and helps materially to light the show windows all along the street.

The lights are turned on at dusk and turned off at midnight. The total amount for gas and maintenance is divided by

the total business frontage, each merchant paying his proportionate share for a foot front per month. These posts are not on special meters or on special mains, but the consumption of each post is estimated and gas is sold at the rate of 55 cents per thousand feet.

The installation necessitated a change in the gas company's franchise to allow them to sell gas without meter measurement.

Ornamental Arc Lights

The new system of public ornamental electric street lighting recently installed in the city of Baltimore, Md., is the first installation of its kind in the country with the single exception of a small installation in the city of New Haven, Conn., and is the largest single initial installation of public ornamental street lighting in the country, comprising some 600 posts, covering approximately sixty blocks in the business district of the city. The promotion of this system was accomplished by Geo. A. Miller.

The lamp employed is the new ornamental inverted luminous arc recently perfected by the General Electric Company. Its chief characteristics are its power of distributing a large volume of light evenly in all directions and the facility with which it may be employed in ornamental street lighting—that is, inverted on the top of an ornamental street lighting standard or post.

One of the peculiarities of the ornamental inverted luminous arc is that owing to the design of the globe it has the faculty of absorbing all shadows, including the shadow of the post itself upon which the lamp is erected, and at the same time diffuses an even volume in all directions.

Owing to the construction of the globe, every inch of which is designed with a view of achieving its particular purpose. it requires a post or lighting standard of a special design to conform to the contour of the globe. In the case of Baltimore, the Municipal Art Commission designed the standard used in that city.

ORNAMENTAL LIGHTING.
Day View, Atlantic City Boardwalk.

The city of Baltimore, in contract with the local electric company, namely, the Consolidated Gas, Electric Light and Power Company, agreed to light and maintain the system after it was installed. The money to defray the cost of the street equipment complete was subscribed by the merchants and property owners along the streets thus lighted at so much per front foot each, according to his individual frontage, and the local electric company agreed, in addition, to furnish its present underground equipment and such other new copper cable as was necessary and make service connections to the new posts that were put in, as in most cases these new lighting standards were placed in the holes made vacant by the removal of the old system.

ORNAMENTAL LIGHTING.
Night View, Atlantic City Boardwalk.

ORNAMENTAL LIGHTING.
Two Light Standard With Gas Lamps.

ORNAMENTAL LIGHTING.
Night Transformation Effected by Gas System Shown in the Above Photograph.

Quartz Tube Mercury Arcs

The latest development in street lighting, and one which is yet in the early experimental stage, is the quartz tube mercury arc lamp. There has recently been installed on Randolph street, in Chicago, a trial installation, including six of these lamps. The primary object of this system was to attract trade, and it converts a dark street devoid of sign lights into a well-lighted avenue illuminated to a degree several times brighter than moonlight.

ORNAMENTAL LIGHTING.
The Quartz Tube Mercury Arc.

The units are placed high on the side of the buildings, and in such a way that there is a uniformity of light over the whole street. The six lamps are suspended from boom hangers at a distance of 8 feet from the buildings and 40 feet above the sidewalk. In the 320-foot block the six units are ranged three on each side of the street, the opposite rows being staggered, thus making the distance between lamps on the same side of the street 128 feet, or one lamp for each 64 feet of street. As the width between building lines is 80 feet and each lamp clears the buildings by 8 feet, the distance between the two rows of lamps is 64 feet, thus placing a lamp at two diagonal corners of each 64-foot square.

The color from the lamps approaches white, with only a trace of the characteristic bluish green mercury flame color. The candle power with clean glass globes and reflectors is stated to average 2,500, with a maximum of 4,900.

The lamps burn from dusk till 1 a. m. Averaging seven hours per night, at 3 cents per kilowatt hour, the total energy and maintenance cost per year is only 69 cents per curb foot. Practically the only maintenance required is periodical cleaning of the outer globes, which is a much simpler operation than with flaming arc lamps. Renewals of the quartz tubes will probably be much fewer than allowed for; they can be broken only by very careless handling. There is no trimming needed, as there is with all kinds of carbon or flame arcs. To facilitate inspection and cleaning the lamp suspension gear can be swung toward the most available window, thus making the lamp readily accessible. For the entire equipment of lamps, mountings and wiring, the investment cost was $1 per curb foot.

Conclusion

Among the existing examples of ornamental street lighting a number of different schemes have been used for securing the lights.

Contracts have been made with so many

parties and combinations of parties that it has been impractical to standardize on any particular scheme. Local conditions almost entirely determine the contracting parties, depending to a great extent on who agitates the movement for better street lighting.

Ordinarily it is unsatisfactory for the lighting company to have a contract with the property owners, merchants or tenants, individually. This form of contract involves so many people that there is a constant source of annoyance when anyone becomes dissatisfied, moves away or for other reasons desires to be released from his portion of the expense.

Perhaps one of the best methods of handling this class of business is that of securing contract with the city for the service, and if necessary a special tax assessment on property holders and merchants in the affected district, to pay the cost of the installation.

The proper illumination of streets is a matter of great importance, both by reason of the benefits obtained from good lighting and because of the expenditure involved in securing such lighting. Sufficient professional skill, proportionate, of course, to the importance of the system to be installed, should therefore be engaged to secure the adequacy of type of unit chosen. The types above mentioned all possess points of merit and are presented as examples of good practice in street lighting. All of them are worthy of investigation by cities which are confronted by the problem of securing "more light."

ORNAMENTAL LIGHTING.
Brilliant Effect of Quartz Tube Mercury Arcs on Randolph Street, Chicago.

CHICAGO'S RECREATION CENTERS.

By Sidney A. Teller, Director West Park No. 2, Chicago.

CHICAGO has one of the best systems of recreation centers in the world. As regards equipment, cost of buildings, and maintenance, it leads all cities. This wonderful system of recreation centers has developed with the newer ideals of social recreation and the benefits to any large city from adequate play space for the children of that city and sufficient recreation opportunities for the working boys and girls, and the adult population.

SIDNEY A. TELLER.

Our ideas of recreation have been greatly changed. A few years ago we thought that mere play space was sufficient for children in a large city . From that we have developed the idea—first, of a properly equipped space; secondly, of a properly supervised space, and now, that same space to be so equipped and supervised as to be used all year around. This has been made possible thru the field house idea.

Chicago has seventeen social, civic, neighborhood centers under the control of three park systems: West Chicago Park, South Park and Lincoln Park systems. These seventeen small parks represent an investment for buildings and grounds of about six million dollars and the annual cost of maintenance of about five hundred thousand dollars.

The South Park system in 1903, under Henry G. Foreman, conceived the field house idea, and in 1905 the first grounds and buildings were opened to the public. This wonderful outlay of money for the public use was made possible thru the issuing of bonds which were first submitted to the vote of the people of the community. Considering the city in general, the location of these park sites has been with reference to other existing playground and recreation places, congestion of population, death rate from tuberculosis, existing schools and general social conditions. In several instances the park commissioners have purchased land sites occupied by houses and in addition to building a park have removed detrimental tenements. For example, the site of West Park No. 2, less than three acres of land, was covered with fifty -seven houses. These houses showed a population of 597 people. In such an environment people do not have opportunities for play, recreation, cleanliness and social intercourse. The children have to play on the streets, the houses are contaminated with tuberculosis and disease. Tuberculosis and infant mortality are high and many boys and girls find their way to the Juvenile Court. Our existing large parks at the time these smaller parks were built, were too far away from the neighborhood of our working classes to allow the people of these localities to make use of them. Also, our foreign people living in the slum and congested neighborhoods can not afford to go to the parks. The new idea is to bring the parks to the people.

Small children will not go more than a quarter of a mile to a playground. They cannot get out of their radius of consciousness, get into foreign places, cross dangerous street car tracks—so for a playground the radius of efficiency is at

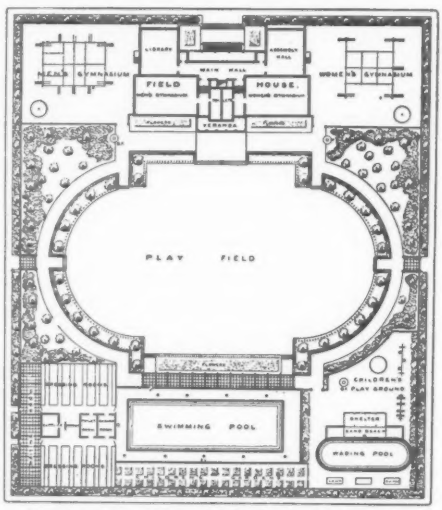
most, one-half a mile. Therefore, the first thought in these play spaces was to provide adequate facilities for the play of little children. The play spaces have been well equipped with sand courts, well sheltered, clean wading pools, swings, teeter-totters, merry-go-rounds and slides. Children under ten years of age are allowed to play together and in addition to the play opportunities offered, usually a supervisor with knowledge of children's games and activities is in charge.

After boys and girls reach the age of ten years they have different impulses in their natures and to meet this, separate play spaces are set aside; first, for the boys over ten years of age, and second, for the girls over ten years of age. The girls' outdoor gymnasium is equipped with a frame which supports incline ladders, climbing poles, climbing ropes, traveling rings, flying rings, etc. There are also lawn swings and giant strides apart from the frame and usually enough space for the girls to engage in gymnasium games. In charge is a woman's gymnasium instructor, who teaches the correct use of the apparatus and also teaches new games and folk dancing.

On the boys' side we also have the outdoor gymnasium frame with similar equipment. In addition, however, are bucks, horses, chinning bars, parallel bars, and track and field apparatus. Adjacent to the boys' gymnasium frame is a large play field, which has a running track, pits for high and broad jumping and shot putting. Here the boys can play playground ball, fly kites and have all kinds of athletic contests.

The programs for outdoor work for the different play spaces include lots of free play, group contests, athletic and field events between different parks and a play festival or a closing exhibition for summer. On these play fields band concerts are given at the different small parks and sometimes arrangements are made for outdoor stereopticon pictures. In fact, all of the opportunities, outside of boating, of the large parks are offered at these neighborhood centers. The fundamental idea of providing sufficient and adequate recreation in these play spaces for the children, is well taken care of.

Chicago has twenty-seven miles of lake front and only three bathing beaches. Where shall the mass of these two millions of people get a bath or a swim? Over half of Chicago's population lives in districts which do not afford proper bathing facilities in the home. One of the greatest things that our recreation system has, is the wonderful equipment of outdoor swimming pools and sufficient indoor shower baths. The swimming pools are in operation from approximately June 1st to October 1st. Suits, towels, soap, lockers, shower baths, life guard supervision, are all given absolutely free to anyone and all using these facilities. The pools are kept up to the highest



CHICAGO RECREATION GROUNDS.
Plan of West Park No. 3, Chicago.

standard of sanitation and a strict enforcement of the rule that each person using the swimming pool must first take a warm shower bath and be inspected, prevents contamination of the pool. The indoor shower baths run all the year around. One park in which, under the old conditions, there was only one bath tub in the block, in the year 1911, had a total attendance at the swimming pool which exceeded 155,000, and the shower baths were used 149,000 times. In 1911, the total number of shower baths given in the small parks of Chicago exceeded

CHICAGO RECREATION CENTERS.
Typical View of Congested Section of West Side, Chicago. Old Building Being Torn Down by West Chicago Park Commissioners.

one and a half million and during the one hundred days which the swimming pools were open, the total attendance nearly reached the million mark. All this was done without one cent of direct cost to the public and without a drowning due to carelessness of the supervisors. People often say how much these recreation centers cost Chicago. The important thing is not how much they cost Chicago, but how much Chicago is saving thru these wonderful small parks. The "social profits" from swimming pools and shower baths alone, with the benefits derived in health, cleanliness, and revitalization, exceed the total cost of maintenance of the entire parks.

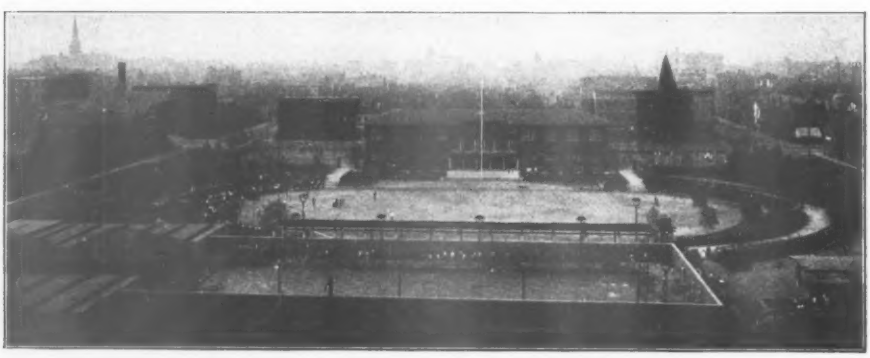
With the old idea of park centers these spaces were used only in the summer time and when the weather allowed. The

CHICAGO RECREATION CENTERS.
Showing Children at Play on Site Formerly Devoted to Unsanitary Crowded Tenements, Shown Above.

Chicago system, with their field houses, makes use of these play spaces the whole year around. With the field houses, which are equipped with separate gymnasiums for boys and men, girls and women; with sufficient locker and shower room facilities; large assembly halls; club rooms and library; and in some parks, a lunch counter; the same opportunities for recreation and social betterment that are given outdoors in the summer time can be carried on indoors in the winter time. The day the outdoor gymnasiums are closed in the fall of the year, the indoor gymnasiums are opened and the regular class work is carried on from 3:30 in the afternoon until 9:30 at night. School children are taken care of until supper time, and after supper the working boys and girls and the adult population have full use of the parks. The instructors, of course, are employed the year around and in addition to the regular class work there are inter-park contests in basketball and indoor baseball.

Different neighborhood clubs, societies and organizations hold their meetings in the club rooms of these recreation centers. The purposes of these clubs are varied, covering athletic, social, pleasure, literary, musical, first aid to the injured, charitable, public speaking, school alumni, military, civic, etc. Week after week these clubs meet and practice the principles of democracy, then thru interclub debate on such subjects as direct election of senators, employers' liabilities. woman's suffrage, these young men and women are training themselves for the citizenships of tomorrow. These field houses are the people's club houses. They are the schools of democracy evolving a better citizenship which must be. The influence of these park centers does not stop in the immediate neighborhoods of the park. The swimming pools and the club rooms will draw for the distance of a mile. The civic and social benefit cannot be estimated. The big lesson that Chicago is learning is that park centers should be planned in advance of the growing population; that a city should have sufficient recreation centers set aside for the people of each district; that prevention is better than cure.

Again we emphasize it is not how much these recreation centers cost Chicago, but how much Chicago gains; how much social profit we are giving over to the community. The total attendance in these park centers last year exceeded eight millions, in all their uses, indoor and outdoor gymnasiums, shower baths and swimming pools, assembly halls and club rooms; library and lunch rooms. These small parks stand for applied justice, neighborliness, democracy, good citizenship and brotherhood. They give health instead of disease, wholesome normal boyhood and girlhood instead of delinquency. In terms of better citizenship their value cannot be estimated.



CHICAGO RECREATION CENTERS.
Bird's Eye View, West Park No. 3, Chicago.

METHODS OF WATER PURIFICATION.

THE most common reason given for purifying a public water supply is that it may be made safe from a hygienic standpoint, but frequently it is necessary to proceed with the purification only so far as to remove mud, vegetable stain, grosser microscopic organisms, soluble and suspended iron, and in some districts to remove excessive hardness or abnormal corrosive action on pipes and offensive odors and tastes.

Physical Purification of Water

The application of methods sufficient to produce the sort of purification needed for the usual purposes of a water supply not dangerously contaminated were described in a recent paper by George W. Fuller, consulting engineer, which shows that it is frequently sufficient and certainly economical to produce the partial purification.

Sedimentation

Plain sedimentation is the simplest method, but at best it removes but 50 to 75 per cent. of the total suspended matter, the total removed depending upon the state of the river and differing materially with different waters. Prior to 1897 most water supplies drawn from the larger rivers were purified by sedimentation only, and were much of the time far from satisfactory.

A few cities extended the period of sedimentation by means of large reservoirs, some of them large enough to give an opportunity to select the flow of water in the stream which had the least sediment to get rid of. This method is expensive and only available in special cases.

Coagulation

Hastening the process of sedimentation and increasing its efficiency by addition of a sulphate of alumina or sulphate of iron, thus producing a coagulation of the impurities and greater size and weight for the particles to settle out was an early addition to plain sedimentation. This produces a fairly clear effluent if properly applied and the dose of chemical is carefully adjusted to the quantity and quality of turbidity, and is in use in many places, notably cities located on the Missouri river, which is noted for the quantity and extremely fine division of the particles of sediment, making it practically impossible to clarify the water by plain sedimentation.

It is difficult to correct errors in dosing the water, after the treated water has reached the settling basins, so that there are sometimes periods of muddy water for consumers, even with the most careful chemical supervision of the treatment of the water.

Sterilization with hypochlorite of lime is now sometimes added to the coagulation, at times when there is any reason to suspect danger from organic pollution, and, when filtration is considered too expensive, the coagulation method, with the addition of the sterilization process when necessary, produces very reasonably satisfactory results.

Sand Filtration

Plain sand filtration was first advised for a city in this country in 1867, and put in operation on two small Hudson river city supplies some five years or so later. This process was expensive, and its use did not spread until the experiments of the Massachusetts State Board of Health demonstrated the practical necessity of this process or its equivalent to remove danger from bacterial contamination.

Sand filters, when operated at two to six million gallons filtered per acre per day, are efficient in removing fairly coarse silt in large amounts. Fine particles pass through, however, even at rates of filtration as low as 2.65 million gallons per acre per day. This is true very generally of American river waters, even after prolonged sedimentation.

If, however, the coagulation process is used and the water is allowed to stand for 18 to 24 hours before flowing on the sand beds, the coagulated sediment does not reach the sand to clog the filter, unless mistakes are made or the rate of flow of water through the purification plant is

pushed too fast. In such cases there will be serious clogging of the filters and frequent cleaning will be necessary. The filter beds and their cleaning, the large sedimentation basins and the coagulation plant all add to the cost of the effluent, so that this combination is seldom, if ever, used, unless bacterial purification is at the same time demanded.

In a few cases pre-filtration is resorted to in addition to sedimentation, thus relieving the fine-sand filters of a portion of their work. If there is not too much fine sediment in the water, this process is satisfactory. At Steelton, and to some extent at Pittsburg, Pa., coagulation is added to th pre-filtration or straining device.

Mechanical Filtration

Where coagulants are required, mechanical filtration seems to be the most efficient method of clarifying water. This process is simply sand filtration at a rate of two to three gallons per square foot per minute, with special provision for washing the filter quickly and easily, once or twice a day, by reversing the flow for five minutes at a time, using mechanical methods or compressed air for agitating the sand during washing and wasting the wash water into the sewer. This process produces water of excellent appearance, and when the apparatus is operated with that end in view, produces excellent results in the removal of bacteria. There are some three hundred such plants in operation, and this process is the one of most general application.

Color Removal

Ordinary sand filters remove one-fourth to one-third of the color from the water passing through them. Sulphate of alumina as a coagulant aids in color removal, but sulphate of iron and lime do not. Overdose of sulphate of alumina to a part of the water treated, offset by following underdosing, seems to increase the amount of color removed at Springfield, Mass. Intermittent filtration aids in decolorization by the aeration of the filter bed between applications of water.

Removal of Tastes and Odors

Microscopic growths in reservoirs give much trouble at times. They may be removed by filtration, with danger of frequent clogging of the filter, and by treatment with hypochlorite of lime or sulphate of copper, the latter being in more general use, because, apparently, more efficacious. Use of hypochlorite before filtering is advantageous.

Most removable tastes and odors, and all of those which are seasonal in their appearance, are due either to organisms which grow in the water or to the decomposition of the dead organisms and to the absorption of the products of decomposition by the water. This decomposition having removed the oxygen from the water, aeration is a great help in removing the products thereof or in carrying the decomposition through by the aid of the oxygen to an unobjectionable stage.

Water Softening

Removal of iron in water by aeration and sedimentation removes taste, odor, stain and some hardness, with more or less completeness, filtration completing the removal of objectionable amounts.

There is but one municipal water softening plant, though there are many in use by railroads and manufacturing plants, the process being most easily applied on the comparatively small scale of the latter plants. Grand Rapids, Mich., is to have a softening plant in connection with its new filters. Lime or lime and soda are used and temporary hardness can be reduced some 50 per cent.

Corrosion of Pipes

The removal of mechanical impurities by filtration, or coagulation and sedimentation, or all three, takes out the material which protects pipes from direct contact with the water flowing through them, and at the same time the processes, especially that of coagulation, seem to produce an amount of carbonic acid sufficient to corrode mains and service pipes. This effect is noticeable where soft waters are treated, but the hard waters are able by deposits on the pipes to give them protection. This is a problem which has been studied in connection with the new Catskill water supply for New York, and it is believed that the amount of carbonic acid can be closely regulated by the addi-

tion of proper amounts of lime and soda at the proper places.

With so many methods and combinations of methods for partial purification of water, nearly all of which can be made efficient for bacterial purification, also by greater care in manipulation or by some changes in program, any city can find the one which will be most economical and inexpensive under its conditions, by having a careful expert study made of the necessities of its case.

Bacterial Purification of Water

The processes for rendering water supplies hygienically pure are described by Allen Hazen, consulting engineer, New York, in a recent paper.

Filtration

Emphasis is laid upon the skillful operation of filters as the essential to bacterial purification. The general design of both slow sand and mechanical filters is not materially different from that for simple physical purification, but there must be material differences in operation. Mistakes in treatment can be corrected only with the utmost difficulty, and may readily prove fatal.

Germicidal Treatment

It has become quite common to treat the effluents from the best of filters, especially at critical seasons of pollution, with hypochlorite of lime as a germicide, the effect of very small amounts in clear water, with little organic matter therein, being almost marvelous.

Ozone has been tried, but is expensive and difficult of application.

Sulphate of copper has been used as a germicide before filtering, as well as for killing algae, but many superintendents object to it because of its poisonous nature, although the metallic residue is removed in the process of filtration.

Ultra-violet rays have been suggested as one means of destroying bacteria, but no plants have been installed in this country.

Chlorine gas is used in Cleveland, O.

Hypochlorite of Lime

Hypochlorite of lime must be applied in comparatively large quantities to raw water, for it must produce enough oxygen for the oxidation of the organic and other matter in the water, as well as for the destruction of the bacteria. The quantity must fluctuate with the conditions of the water. The amount necessary for treating the filtered water is less and is more uniform, and it is possible to remove with uniformity and certainty 99.9 per cent. or more of the bacterial life.

THE ADVANCE IN STREET LIGHTING.

IT seems a great advance from the condition of twenty years ago, when a city of 175,000 population made itself satisfied with an open arc lamp on every alternate street corner, to the present time when lamp standards are placed even as close as 50 feet apart and the total illumination spread over the block is perhaps 2,000 candle power as compared with the former rated 2,000 candle power but actual 800 to 1,200 candle power concentrated at one end of the block. Measured by results, the difference is still greater than these figures would indicate.

Much of this advance is due to the advance in the art of electric lighting and in the ability to supply better illumination at lower cost per unit and the rate of development of street lighting has followed the development of the necessary apparatus very closely. Therefore much of the modern system of what is termed ornamental lighting has developed within the last three years, and practically all of it within five years.

Electric Railway Equipment Co. Standard.

Who Pays?

The city's pocket-book is proverbially empty, and the installation of the new systems is somewhat expensive, As a result, the cost of the installation has been borne very largely by the owners or the tenants of the adjoining property. When the current is paid for by the owners or tenants the lighting company pays the cost of installation, the rates being sufficient to cover the initial cost as well as the annual cost of maintenance and operation.

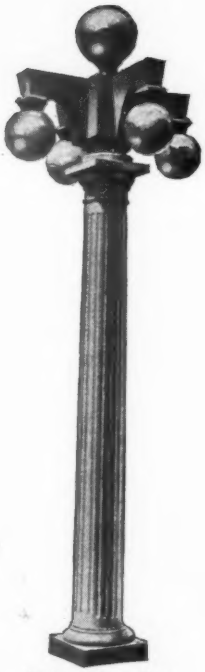
In many instances the city has been induced after a short time to assume the cost of operation, and in almost every municipal electric light plant this is the case.

If the marvelous stories of increase in rental value of property on account of the new lights are true, the city can well afford to do this, because the increase in taxable valuation will take care of a large part of the cost. That they are true is indicated by the willingness with which merchants assume the expense of the installations and of the operation, if necessary. They were not slow in recognizing the business value of more light and better distributed light and more ornamental fixtures and arrangement of the light units. It was only necessary to point to the early successes to remove all doubts wherever there was business enough or prospect of new business enough to warrant the expense.

Where Installed

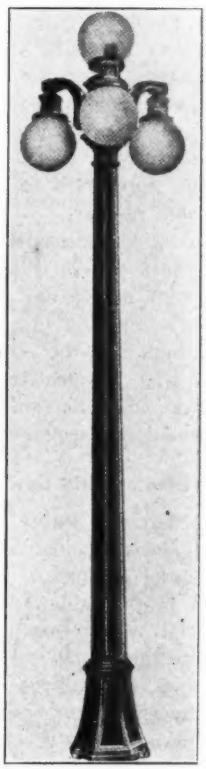
And it is not only the streets devoted to retail trade in the larger cities which adopt the ornamental lighting systems. Indeed, some of them have been a little slow in adopting and extending the uniform systems. On such streets the advertising signs of the merchants have run largely to the electric lighted varieties, and they have been slow to change to the uniform system and drop their individual trade-catchers, and have been equally slow to add the uniform system to what they are already paying for.

In the largest cities, therefore, the de-



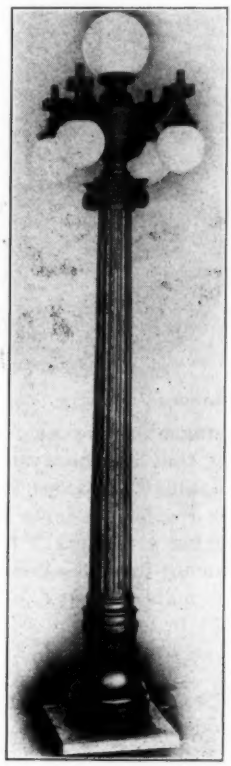
Pettyjohn Co.
Standard.

Flour City
Ornamental Iron Works
Standard.



Wallace Machine and
Foundry Company
Standard.

George Cutter Co.
Standard.

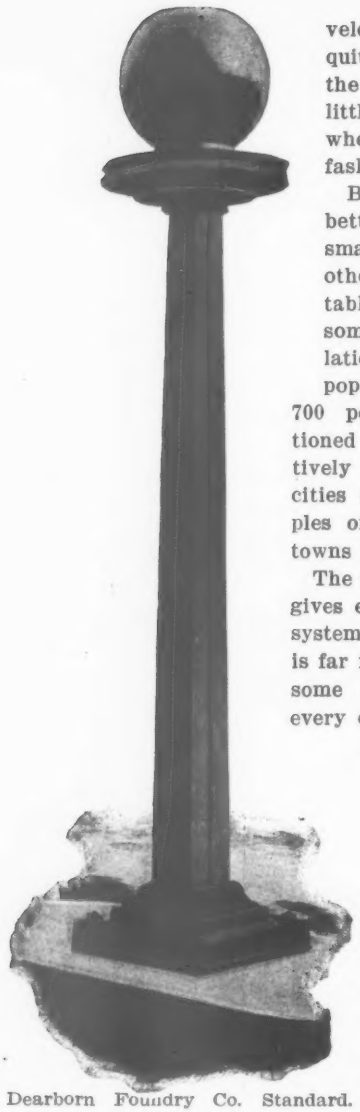


Western Gas Construction
Company
Standard

velopment of uniform ornamental lighting has been quite largely, in outlying districts, which correspond to the smaller cities and towns, or to the retail streets a little off the main arteries, the latter only coming in when the shifting of trade forces them to follow the fashion.

But the smaller cities and towns have taken up the better lighting with avidity and the systems, though small, are none the less valuable in proportion to the other factors in the case. Many of the names in the table will be recognized as those of small cities and some of them are small towns. Pine Bluff, 25,000 population; Fond du Lac, 18,000 population; Pasco, 4,000 population; Rochelle, Ill., 2,500 population; Nashwauk, 700 population, may be mentioned as examples of comparatively large installations for cities of their size, or as examples of the enterprise of small towns in this respect.

The table is representative and gives examples of nearly all the systems which are in use, but it is far from complete. Indeed, in some sections of the country every city with an electric light plant has done something toward developing ornamental lighting.



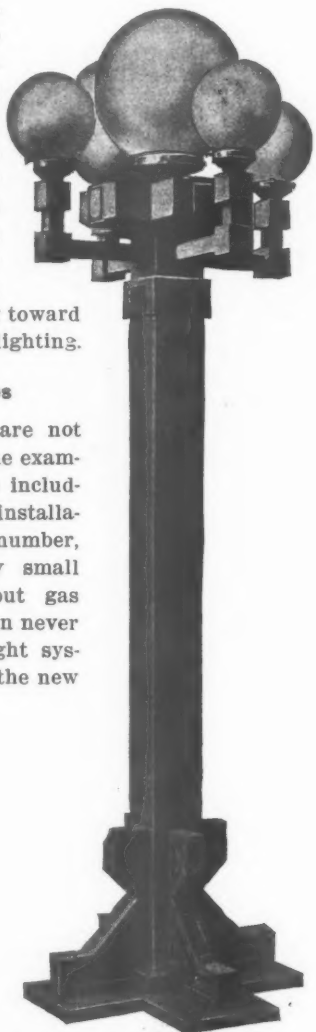
Dearborn Foundry Co. Standard.

Electric and Gas Lamps

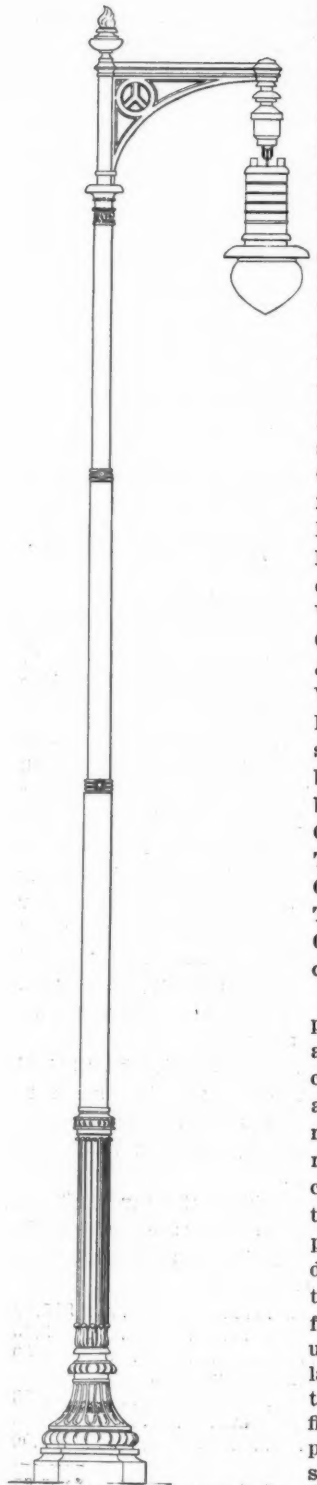
That the lights used are not all electric is shown by the examples of gas-mantle lamps included in the table. These installations are increasing in number, but there are so many small cities and towns without gas plants that the number can never equal that of electric light systems. The dependence of the new systems on the new electric lights is shown by the fact that all the systems use either the magnetite or the tungsten lamps or some near kin to them. For this reason the table gives only A for the magnetite or flaming arc lights, I for the tungsten or other metallic filament incandescent lights and G for the incandescent gas mantle lamps, as the abbreviations for kind of light in use.

Standards

The standards carrying the lights are usually of wrought or cast iron, or steel, or concrete and in one case of cut stone. They are often made by local foundries. Concrete posts are made at home. A few firms



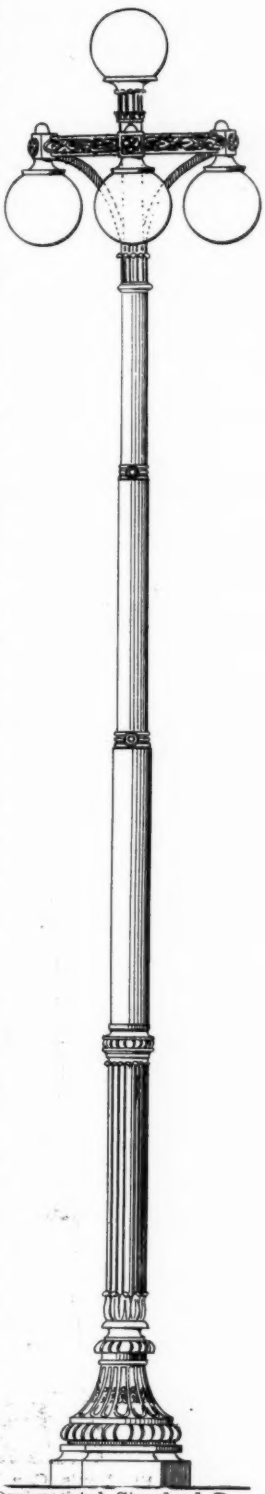
Dearborn Foundry Co. Standard.



Arc Light Standard Designed for the City of Chicago.

make standards for the general market, such as the Waterloo Malleable Iron Works, Waterloo, Iowa; The Pettyjohn Co., 582 N. Sixth street, Terre Haute, Ind.; St. Louis Car Wheel Co., Bank of Commerce Bldg., St. Louis, Mo.; Smyser-Royer Co., Eighteenth and Filbert streets, Philadelphia, Pa.; Paxton & Vierling Iron Works, S. Seventeenth and U. P. R. R., Omaha, Neb.; Ornamental Lighting Pole Co., 1628 Whitehall Bldg., New York, N. Y.; J. L. Mott Iron Works, Fifth avenue and Seventeenth street, New York, N. Y.; Flour City Ornamental Iron Works, 2637 Twenty-seventh avenue S., Minneapolis, Minn.; The Morris Iron Co., Frederick, Md.; Western Gas Construction Co., Fort Wayne, Ind.; Kerr-Murray Mfg. Co., Fort Wayne, Ind.; Giddings & Lewis Mfg. Co., Fond du Lac, Wis.; Davenport Machine & Foundry Co., 1618-44 W. Fourth street, Davenport, Iowa; Dearborn Foundry Co., 1525 Dearborn street, Chicago, Ill.; The Casey-Hedges Co., Chattanooga, Tenn.; Union Metal Mfg. Co., Clifton avenue, Canton Ohio; The Electric Railway Equipment Co., 2905 Cormany street, Cincinnati, Ohio.

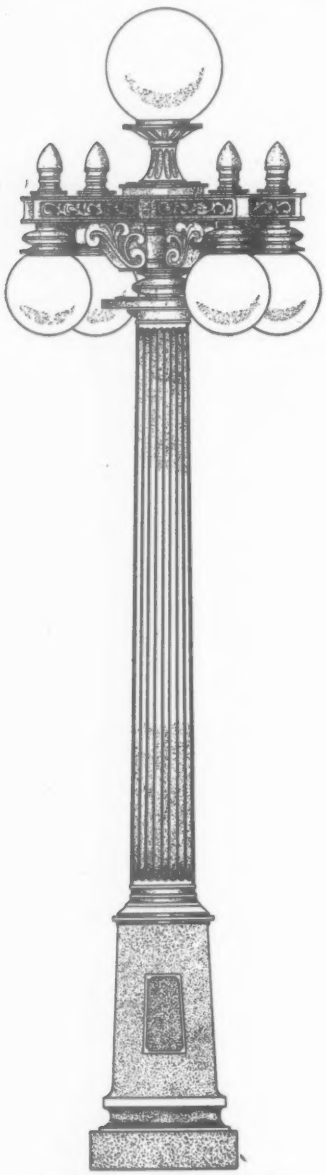
The number of lights on each post varies from one to five. One arc light is sufficient, but in a few cases, particularly along parks and boulevards where the business features of the system are not so prominent, one incandescent light is used. In some of the smaller towns and less important streets, and in residence districts in the cities in which the development has extended so far, three-light standards are used. They are probably 60-watt lamps or one 60-watt on top and two 40-watt lamps below. The five-light standard is the most popular. It may carry any desired combination of lamps. A very common design carries one lamp on top and four lamps on



Ornamental Standard Designed for the City of Chicago.

brackets on the same level below. One or two installations carry the lamps in triangles, one at the apex, two just below and two again below, the globes being reduced in size going down for convenience in design and handling.

All the lamps may be of the same rating, 60, 80 or 100 watts, but it is more common to use a 60 or 100-watt lamp for the top lamp and two or four 40 or 60-watt lamps below. The top lamp in most designs must be upright, but the two or four lamps on the arms below may be either upright or pendant. The distribution of light over the street or upon the buildings should have something to do with the method of placing the lamps, but it is probable that in most cases the decision is made in accordance with the preference of some man or committee as to appearance rather than as to use.



St. Louis Car Wheel Co. Standard

With so many sources of lamp standards there are, of course, many varieties of design. A few of these varieties are shown in the accompanying drawings and photographs as samples of what designs are in use. They are presented without comment as to their artistic qualities or their adaptability for their work. These matters must be considered by those making the selection for a definite location.

Cost of Service

The distance of lamps apart varies largely, being governed by length of blocks and length of pocket-books. The popular cost, as indicated by the table, is from $1.20 to $2 per front foot. But few cost less than the former and several run well over $2. The cost of installation per post is also quite variable. Some of the figures in the table are very low, such as $30 for Walla Walla; $4, evidently for the concrete post alone, or $18 when copper capped, in Oklahoma City; $35 for cut stone posts in Bloomington, Ind.; and $24 in Pine Bluff. A few are very high, such as $330 for arc light posts in Chicago on underground circuit.

Cost of operation also varies from $17.50 per year for 3-light posts in Peoria to $135 for 5-light posts in Chicago; and per front foot from 68¾ cents in Duluth to $1.92 in Atlanta.

The cost of a 5-light standard is itemized as follows, due allowances to be made for cost of installation, kind of materials, etc., for each special case:

Post	$35.00
Lamp and sockets	5.60
Globes	4.00
Erecting, wiring post and concrete base	8.00
Supply cable, 65 feet	16.25
Laying cable	39.00
Total cost per post	$107.85

STATISTICS OF INSTALLATIONS OF ORNAMENTAL STREET LIGHTING SYSTEMS.

City.	No. posts.	Lights per post.	Kind of light.	Distance apart. feet.	Lamp rating.	Cost of Installation.	Cost of Operation per year.	Installation paid by	Operation paid by
Anniston, Ala..	...	5	I	45	80w	....	$1.65F	Company	Merchants
Pine Bluff, Ark.	150	4	I	*	....	$24P	$36P	Merchants	Merchants
L. Angeles, Cal.	...	5	I	100	....	125P	....	Merchants	
Riverside, Cal..	...	3	I	100	260wt	...	....		
Pueblo, Col.....	40	1	G	77	3M				
Pueblo, Col....	...	1	A	135	....	65P	72P	Company	Merchants
N. H'ven, Conn.	75	1	A	87S	520wt	3F	1.60F	Owners &	Merchants
Atlanta, Ga....	239	..	I	70	....	2.25	1.92F 45P	Owner & tenant	City
Bloomingt'n, Ill.	28	5	I	60	....	$2600T	....	Merchants	City
Chicago, Ill., Co.	2800	1, 4, 5	I	40-125	1-250w 4-60w 5-60w	....	91 to 135P	Company	Tenant
Chicago, City†..	10000	1	A, I	150S	100w	330PAU 110PAO 80PI	49.88A 21.13I		Municipal
Mendota, Ill....	...	3	I	80	60w	12.50‡	48P	Merchants	City
Pana, Ill.....	...	..	I	....	....	50P	....	Merchants	City
Peoria, Ill., bus.	275	5	I	70	....	2F	40P	City	City
Peoria, Ill., res.	135	1	I	100	....	.50F	17.50P	City	City
Rochelle, Ill....	150	3	I	66	60w	....	....	Municipal plant	
Bloom'gt'n, Ind.	120	..	I	....	....	35P	12P	City	City
Ft. Wayne, Ind., bus.....	190	5	I	90	....	1.85F	21P		City
Ft. Wayne, Ind., res.....	60	1	I						
Gary, Ind.....	260	..	I	50	....	1.25F	.71F	Owners	City
Indpls., Ind....	2 mi.	5	I	84	100w	....	1.05F	Company	Tenants
Mishawaka, Ind.	...	5, 3	I	50	5 posts at each street corner				
Burlington, Ia..	...	..	I	....	....	1.67F	....		
Ced'r Rapids, Ia	...	..	I	68S	340wt	100P	70P	Owners	Tenants
Des Moines, Ia.	362	..	I	56	....	1.48F	59.50P	Owners	Tenants
Waterloo, Ia...	181	5	I	90	40, 60w	1.30 to 1.50F	....	City	City
Baltimore, Md..	600	1	A	....	....	....	....	Owne. & Mer.	City
Cambridge, Mass.	36	2	I	150S	200c.p.	....	82.44P	Company	**City
Waltham, Mass.	13	2	G	50	....	48P	72P	Company	Merchants
Duluth, Minn...	90	5	I	92	100w	120P 1.50F	55P .69F	Ten. & Own.	City
Fariba'lt, Minn.	106	..	..	....	....	....	....	Company	
Min'p'lis, Minn..	600	5	I	100	80c.p.	145P 2F	78P 1.25F	Owners	City
Nashwauk, Minn.	22	3	I	95	60, 40w	....	....		
St. Paul, Minn..	350	5	I	75	60, 100w	....	....		
Virginia, Minn..	...	..	I	80	100w	....	....		
St. Louis, Mo..	...	3	A	60	4 amp.				
Billings, Mont..	199	..	..	95	320wt	80P	60P		Tenants
Omaha Neb....	...	..	..	....	....	....	....	Owners	
Newark, N. J..	123	1	A	100	....	....	....		
Manchester, N. H.....	32	1	G	....	5M	....	....	Merchants	Merchants
Auburn, N. Y..	135	..	..	85	....	2F	90P	Company	City
Buffalo, N. Y..	83	..	..	70	....	1.20F	37.50P	Own. & Ten.	City
Niagara Falls, N. Y.....	...	..	..	....	....	....	....	Owners	
Poughkeepsie, N. Y.....1.5 mi.		4	I	90	100w	....	††48P	City	City
Syracuse, N. Y..	116	..	I	50	....	1.65F	90P	Mer.	Mer. & City

STATISTICS OF INSTALLATIONS OF ORNAMENTAL STREET LIGHTING SYSTEMS.

City.	No. posts.	Lights per post.	Kind of light.	Distance apart. feet.	Lamp rating.	Cost of Installation.	Cost of Operation per year.	Installation paid by	Operation paid by
Fargo, N. D...	...	5	I	....	....	....	....	Owners	City
Grand Forks, N. D.....	136	5	I	8B‡‡	....	$30,000		Municipal plant	
Cincinnati, O...	...	5	I	....	....	....	....	Own & City	
Cleveland, O...	...	3	G	....	2M		also has electric lamps		
Columbus, O...	900	5	replacing former arches						
Dayton, O.....	305	..	..	80	....	2.22F	68.50P	Company	City
Hamilton, O...	...	5	..	....	60w	80P	12F	Owners	Tenants
Toledo, O.....	2500	2	A	80	4 amp.	....	....		
Warren, O.....	86	3, 5	I	65-80	80, 60, 40	....	....	City	City
Portland, Ore..	...	3	G	....	....	....	....		
Phila., Pa.....	663	2	A	130	....	....	120.20P		City
Pittsburg, Pa...	...	1	A	90	....	....	....		
Wilkes-Barre, Pa.	120	5	I	75	100w	160P	200P	Company	Owner
Houston, Tex...	105	1	A	....	....	....	70P		City
Ogden, Utah...	...	5	I	132	60, 100w	....	....		
Norfolk, Va..	50 arches	10	I	100	70c.p.	....	....		
Pasco, Wash...	42	3	I	130	60w	100P	30P	City	City
Seattle, Wash., bus.	1116	5	I	85-100	50w			Municipal plant	
Seattle, Wash., res.	515	3, 1	I	150-200	50w			Municipal plant	
Walla Walla, Wash.	126	3	I	....	60w	30P	30-35P		
Fond du Lac, Wis.	58	5	I	....	60, 100w	....	....	Merchants	City
Cheyenne, Wyo.	112	5	I	....	....	75P	45P	Merchants	Merchants
Vancouver, B.C.	...	5	I	89-134	75c.p.	2.10 to 2.65F	....	Owners	City
Hamilton, Ont.	8 blks.	5	I	45	100, 125w	....	1.50F	Company	Merchants
Saskatoon, Sask.	500	5	I	100	....	.90F	48P	Owners	City

* 11 per block.

† This is an estimate of the system now being installed by the municipal lighting plant of Chicago under the recent contract made with the Chicago Drainage Canal Commissioners for current.

‡ Average cost per tenant for adjoining stores.

** Merchants pay $500.

†† $14.90 of the $48 cost per year at Poughkeepsie is for maintenance, the rest for current.

‡‡ In Grand Forks there are eight posts for each block of street.

I—Incandescent, tungsten, Mazda or like variety of lamp.

A—Magnetite, flaming arc or like variety of lamp.

G—Gas lamp.

w—Watt.

wt—Total wattage of lamps on post.

M—Gas mantles in lamp.

c.p.—Candle power.

P—Cost per post in column of cost of installation; cost per post per year in column of cost of operation.

F—Cost per front foot in column of cost of installation; cost per front foot per year in column of cost of operation.

T—Total cost of installation.

U—Underground, O—Overhead wiring.

S—Staggered, i. e., the lamps on one side of the street are set half way between the lamps on the other side of the street. In cities not marked S the lamps are opposite each other on the street.

The cost of current in cents per kilowatt-hour is estimated as follows: In Anniston, Ala., 7 cents; Chicago, minimum, 5.7 cents; Ft. Wayne, 3.5 cents; Indianapolis, 1.8; Waterloo, Ia., 5.5; Wilkes-Barre, 5.2; Houston, Tex., 4.24 cents; Pueblo, Col., 3.5 cents.

VITRIFIED SECTIONAL SEWERS.

AN interesting piece of sewer construction is now being carried on in Indianapolis by the Julius Keller Construction Company, of that city. The material being used on the job is a recently invented type of vitrified hollow tile manufactured in sections, which are laid in cement mortar to form the sewer.

Attempts have been made to manufacture a hollow tile sectional unit which could be used on sewer work, but in every previous case difficulty has been encountered in securing an end connection between the blocks, as the ends were made flush and could not be laid to a tight joint.

The blocks being used on this job have remedied this fundamental defect. The lengthwise joints are effected by generous male and female, dovetailed joints which are filled with cement mortar when the blocks are laid. The end joint is made in the old style of "ship lap" joint, formed by an overlapping end compensated by an under-cut end on the next block. The photograph illustrates the formation of the ends of the blocks and also the system of webs which strengthen and make practical this form of joint. The blocks were invented by an engineer of the American Sewer Pipe Company.

The sewer now under construction by the Keller Company is the second in which they have used this type of block. The first was a three-foot section, and the present job is a four-foot six-inch sewer, and the contractors state that they are entirely satisfied with the blocks on both jobs.

The present work is being carried on thru about 13.5 feet of gravel, which is stiff enough to require but little sheeting. The trench is 6 feet 6 inches wide. At present a small force of only ten men is carrying on all the work at the rate of about 40 or 50 feet a day, including the digging, sheeting, laying the sewer and back filling.

The trench is excavated by shovels, the bottom being shaped as nearly as possible to the outer radius of the sewer. The three center rows of blocks are then laid to a template, which in this case consists of a semi-circular board, much the same as is used in brick sewer work, tacked to the sheeting at grade. The lower openings beneath the web in these blocks provide under drainage, so that though about nine inches of water is encountered on this job, the contractors find it necessary only to pump previous to laying the three bottom rows. The blocks themselves then take care of the drainage, so that the remainder of the section is built with a perfectly dry sewer for the construction of the arch.

The successive rows up to the spring line of the arch are then laid, a 2-to-1 cement mortar being used in the dovetailed joints on the sides of the blocks, and the ends being thoroughly filled with mortar. The side joints are so constructed that they fit easily into place so that only the center or key blocks need to be slipped into place from the end. Each successive row from the bottom is thoroughly back tamped, so that when the spring line is reached a firm foundation is provided against the side thrust of the arch. This feature, states Julius Keller, Jr., a member of the firm, is the secret of the successful use of the sectional blocks, and by care in this detail the sewer is made a monolithic circular section, capable of supporting at once such fill as may be made over it. On the three-foot sewer before mentioned the back fill was made by dumping cars from an overhead trestle operated with the trenching machine at the head of the ditch. In some cases the car was dumped from the height of 20 feet or more upon the newly finished section, without any injury to the shell of the sewer.

After the completion of the invert to spring line a specially designed form of centering is used to support the arch. This centering is a collapsible form, supported entirely upon the bottom row of blocks. It is 8 feet in length and has a system of longitudinal ribs held in place by radial braces or spokes at both ends.

VITRIFIED SECTIONAL SEWER.
Showing Details of Invert and Arch and Illustrating End Joints.

These braces are connected to a central axle controlled by a crank arm. The turning of this axle turns the braces and draws them inward, bringing the longitudinal ribs or segments with them. This allows the form to clear the arch of the sewer at all points, so that it may be drawn forward and reset. Striking the center and resetting it occupies only about 30 seconds.

The arch blocks are then placed, supported by the centering, until the key blocks are in place, when the material being excavated from the trench ahead is at once thrown back on the newly completed section. The centering is moved forward as soon as the invert is completed.

Mr. Keller is enthusiastic concerning the ease and rapidity with which the blocks are handled. They are two feet in length, ten inches wide and six inches thick, so are not unhandy to lift and place. They weigh only about 30 pounds,

so are easily handled into the trench. One man easily supplies them on the bank and lowers them into the trench as needed. For this purpose an iron rod about two feet long and hooked at the end is used. The rod is slipped thru the block and hooked and lowered by means of a rope to the men in the trench, who take the block from the hook and use it immediately, so that there is no rehandling of the blocks by the man who lays them.

The laying is done by two men, unskilled labor at 30 cents an hour being adequate while in the case of brick sewers two brickmasons at 75 cents an hour with two or three helpers are required. One man supplies mortar for laying the blocks and has enough time left to give half of his attention to other work, digging or wheeling the blocks to the bank if required.

The construction is much quicker than in the case of a brick sewer. On this job an 8-foot section is laid per hour, including both invert and arch. A comparison of labor and materials used on brick and on the sectional block sewer shows that on an 8-foot section the cost of constructing a brick sewer is roughly $7, while the sectional sewer costs but $3.50.

The sewer being constructed by the Julius Keller Company at the present time is costing about 25 cents per running foot for labor and materials, exclusive of the first cost of the block and of the trenching.

That portion of the sewer which is completed is an excellent piece of work. The joints are well made, tight and smooth, and the interior of the sewer, by reason of the glaze on the blocks, approaches the smoothness of vitrified tile. The sectional block, while yet very new, has made good.

GASOLINE MOTOR HAUL.

By Frank C. Perkins, Buffalo, N. Y.

IN Germany and England coal is now handled very largely by gasoline motor power by means of single trucks and road trains by tractors.

The accompanying cut shows the method of operation of the English gasoline road trains, carrying 15 tons of coal from the Michael Coal Depot, Rangoon.

This gasoline motor system of road transport is said to be the most efficient type of road traction yet evolved, its working capacity being enormous. It is held that its superiority over other forms of traction lies in the fact that it is light, speedy and economical to run. There is no hauling or trailing as with ordinary form of traction engines and trailers, but each vehicle comprising a train is mechanically propelled, although there is only one motor to a train.

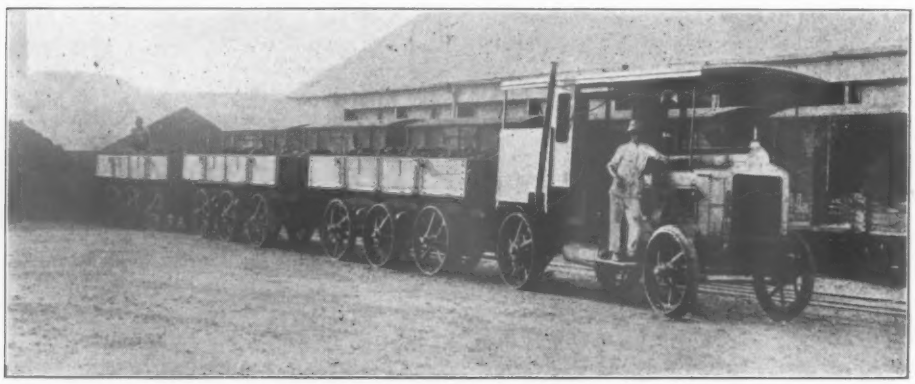
The power consists of an 80-horse-power six-cylinder motor of the Daimler sleeve valve type, and all trains are geared so that they can with ease negotiate, fully loaded, any hill up to a gradient of 1 in 5, 20 per cent., or can traverse comparatively soft grounds and tracks. The wagons each have a useful carrying capacity of five tons, and the usual train will carry a total useful load of twenty tons. The speed of such a train on a fairly hard and level road is up to ten miles per hour, but if more vehicles are added, the speed will then be decreased somewhat.

The six-cylinder 80-horse-power gasoline engine was designed for cooling in hot climates with a large steel radiator of the honeycomb type, fitted with a powerful fan to draw air through the tubes, and a water tank is also provided. The drive from the engine is taken through an efficient cone clutch of large size to the gear box, a flexible coupling being interposed to prevent any undue wear on the bearings. It may be stated that the gear box provides four speeds forward and one re-

verse, and it is so designed that the main driving shaft is continued right through to the rear of the locomotor. Immediately at the rear end of the gear box this shaft is fitted with a worm wheel, which drives a cross-shaft. At the ends of this cross-shaft chain sprockets are provided, and these convey the drive to the rear wheels by means of high-quality roller chains. In this way part of the power from the engine is utilized in driving the locomotor, and the remainder is conveyed through the long driving shaft, mentioned above, to the followers, driving each of these in turn.

It is of interest to note that between the locomotor and the first follower, and also between each pair of followers, two very large universal joints are interposed, so that the drive may be transmitted when the train is proceeding around a sharp bend. In the center of each follower there is a gear box, in which a pair of worm wheels transmit the drive to a cross-shaft, just as in the locomotor. From here a pair of chains leads to the central wheels of the follower, which is thus driven at the same speed as the locomotor. The main driving shaft continues through to the next follower, and in this way the power of the engine is divided among all the vehicles in the train. It should be mentioned that in each driving wheel a spring drive mechanism is fitted, so that any inequalities in the drive are effectively absorbed, and, in addition, ease of starting is insured.

The fact that the steering of the locomotor is communicated to each of the followers is almost as important as the mechanical propulsion of each vehicle, with the result that all the vehicles traverse a single path, forward or backwards, however tortuous this may be. It is explained by noting that on the locomotor a handwheel in front of the driver operates the usual worm and sector gearing of large dimensions, and the motion of the sector arm is transmitted to the front wheels by means of suitable links. These front or steering wheels are centrally pivoted, as are all steering wheels in the followers, and this insures easy action as well as preventing road shocks from being transmitted to the driver's arms and various parts of the mechanism throughout.



GASOLINE MOTOR HAUL.
Road Train Hauling Coal in Rangoon.

Each follower has a self-contained steering mechanism which is automatically controlled by the vehicle immediately preceding it. The direction of the whole train is determined by the driver of the locomotor when going ahead, and, when going backwards, by a man at the last wagon. The steering is simple and ef-

This gasoline road train has high average speed, with economy of power, due to using a light motor, a large percentage of the necessary adhesive weight being furnished by the paying load. A four-ton motor is sufficient to work a train having a tare weight of eighteen tons and carrying a useful load of twenty tons—that is, a gross moving weight of thirty-eight tons.

CHICAGO MOUNTED POLICE.

By Capt. Charles C. Healey, Chicago, Ill.

THE Chicago mounted police squad is not patterned after any other police body. It is a distinctively original, semi-military body, and is constantly being taught new ideas of police duty through means of a weekly school of instruction held at the headquarters, the instructors being Lieutenant Denman and myself. At this school all matters pertaining to street traffic are discussed and any officer with a new idea is free to advance same.

CAPTAIN CHARLES C. HEALY.

At present the mounted squadron consists of 145 men. The average age of mounted officers is 28 years and the maximum weight is 175 pounds. The squadron is divided into two platoons of officers, who work six hours daily and cover every street in the business district, as well as all the important outlying streets. It is estimated that each horse covers about fifteen miles daily, which gives a total travel of 1,875 miles a day. Our discipline is as strict as any military organization in the country.

Mounted officers have definite instructions as to their duty in case of fire, as, for instance, the four officers riding posts on streets adjacent to the fire immediately close traffic from all directions and move all vehicles in proximity to the fire in order to give the fire department all possible room. After this duty has been performed, two of the four officers take posts as near as possible to the burning building and regulate pedestrians.

The late Chief Horan, of the fire department, stated that two mounted officers could do the work of ten men on foot. This is not meant to detract in any way from the efficiency of foot officers, but merely goes to show the advantages of the mounted officer who understands his duty.

When one stops to consider the great volume of traffic passing through our loop district and the smallness of the district, it can readily be seen what Chicago's traffic squad has to deal with. Very few realize that we have the busiest vehicle traffic bridge in the world. It had long been thought that the London bridge had more vehicle traffic in one day than any bridge in this country or Europe, but a census taken in the year of 1911 shows that the Rush street bridge, Chicago, has 16 per cent. more vehicle traffic than London bridge, and that in one hour less time. The actual figures are:

	Vehicles.
London bridge, in 12 hours.....	7,578
Rush street bridge in 11 hours.....	8,972

On this same day 10,372 pedestrians passed over the Rush street bridge.

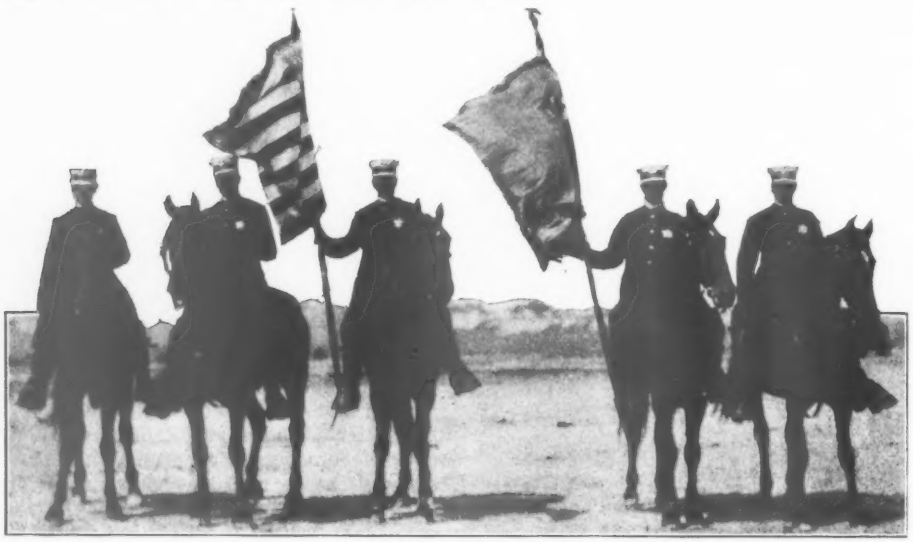
In the days of congestion, before the mounted squadron was anything more than a dream, street railway managers claim that it took a street car eighteen minutes to make the run between Twelfth street and Lake. Now the run can be made in six minutes, a saving of twelve minutes, which is due to street traffic regulations.

Accidents to human life have decreased 60 per cent. since the regulation of street traffic in the loop district. This is important when one considers the tremendous amount of traffic policemen must handle daily in the loop district. There are 3,100 street cars in the loop daily. In 1911 the Chicago City Railways Company carried 358,227,032 persons, 33 1-3 per cent. of whom passed through the loop district.

Although there is no camp life, the mounted policeman is under strict military discipline. He must salute his superior officer and conduct himself at all times as if he were in the cavalry service of the army. On dress parades and in the daily routine the bugle sounds in the quarters and the commands are given by bugle. The first bugle call is sounded five minutes before roll call at 7 o'clock in the morning. Five minutes from the first call the bugle sounds for the assembly. All men must form in line in ranks in the squad room. After the roll call the lieutenant or the captain instructs the men as to the orders from the chief's headquarters and assigns them to their posts. The men are changed once a month from morning to afternoon duty.

Great service has been rendered by the mounted police in strikes, and we would cite in particular the strike of the garment workers in 1911. These people, mostly foreigners, attempted, time and again, to parade through the business district, forming east of the river. They were invariably held in check by two or four mounted officers, and very few arrests were made. This is due to the training received by mounted officers, whose first instructions are to act the gentleman at all times, while being firm in enforcing respect for the law.

A new rule is soon to be taken up whereby pedestrians will have to obey the same rules at crossings as vehicles; it is expected thereby to prevent a great many accidents which now occur owing to a pedestrian crossing the street in one direction while vehicles are going in the other.



THE CHICAGO MOUNTED POLICE.
"Color Bearers" of Chicago Mounted Police.

EDITORIAL COMMENT

ORNAMENTAL STREET LIGHTING

The extension of ornamental lighting of city streets has carried it into small cities to a surprising extent. The total amount in a city is often very small, and it sometimes reminds one of an illumination for a campaign parade, but its effect is nevertheless distinctly favorable.

The earlier methods made use of festoons of electric lights across sidewalks and along curb lines. They are comparatively inexpensive, but do not lend themselves to variety or beauty of design.

A few cities employed arches across the streets, lined with incandescent lamps, the idea having been used first by St. Louis for permanent illumination with gas lights, before the days of electric lights. This permanent use was a development from the temporary illuminated arches used at the great fall parade in that city. When the lights were colored the effects were quite indescribable.

Few of these arch systems were satisfactory, for even if they made a fairly good show at night, they were very unsightly by day, especially after the weather had rusted the metal and soiled every part that would hold soot and dust. Ornamental standards were then devised, and they proved so satisfactory that their use has spread very rapidly. How rapidly they have extended through the streets is suggested by some statistics from the larger cities given elsewhere.

When the city owns the lighting plant it is quite common for the merchants to install the lamp standards, the city then assuming charge of them and keeping them lighted. In some cases of private ownership the companies install the standards and abutting storekeepers or property owners pay for the light at fixed prices.

While some of these systems are somewhat garish and theatrical in design and appearance, they have the same effect upon a town that new improvements always do, emphasized by the fact that the bright light shows up defects very prominently. Unless the town has spent all its money upon the lights, it can hardly fail to improve its sidewalks, curbs, gutters and pavements to correspond, and, most important of all, it moves toward keeping streets and sidewalks clean. No commentary on a town is so uncomplimentary as a dirty street shown up by the brightness of an ornamental lighting system.

THE SOLUTION OF THE STREET RAILWAY PROBLEM

It is refreshing to read a report upon a street railway problem which is so broad and so inclusive and so fair to the interests upon both sides as that upon the present transportation conditions in San Francisco and vicinity, which has just been issued by Bion J. Arnold, the consulting engineer, who has been studying the problem.

The report is notable for two or three things in particular that are of special application in San Francisco, which has been noted for its corporation baiting. But there are many cities more or less under the influence of the same disease, and their citizens will be greatly benefitted if they can reach Mr. Arnold's high and unbiased stand and can come to understand with him that the interests of corporation, city, patrons and citizens are common interests.

San Francisco's legislation, both through the legislature in its charter and through its city ordinances, has been such as to hamper the development of its public service utilities under private management, rather than to help, and the actions of city officials under these laws and ordinances has emphasized the differences between them. The consequence has been inadequate facilities, insufficient service, retardation of development of city districts, misinformation as to company's receipts and profits, all of them causing losses to all the parties interested. The company has not been able to interest the capital necessary for developments; the city has suffered from bad streets, track construction, congestion of streets by cars; the patrons have suffered from insufficient, inefficient and interrupted service; the citizens have suffered from the arrested development of the municipality as a whole, and many of them have suffered from the inability to develop new districts, not to speak of those who have been obliged to live in crowded downtown quarters because the car service was inadequate to carry them back and forth from more open and more healthful districts.

Any one who is interested in the wonderful methods of improving the situation as applied to the case of San Francisco, should read Mr. Arnold's report. It is unassailable from any of the ordinary political standpoints, because it is so eminently fair to both sides.

THE VALUE OF GOOD LIGHTING

The average city in America to-day still bears the earmarks of its haphazard start and somewhat uncertain early development. Little intelligent care was exercised in planning it or in training it so that it might grow along the lines of greatest economy and convenience. Little discredit is this fact, however, to our forefathers. The innovations of the street car, the telephone, the water works system, the central lighting or heating stations, were all vague and uncertain dreams when our cities (at least those of the eastern half of the United States) sprang into existence. And yet each new stage of development has demanded certain expensive changes and adjustments on the part of each growing municipality.

Perhaps no problem of the municipality has had more interesting phases of development than the lighting problem, especially that of street lighting. The first street lighting system was installed in London in the seventeenth century for the purpose of diminishing crime. Crudely constructed oil lamps were maintained by the householders. To recount the long list of improvements since that date would make an interesting story, but would have little bearing upon present-day needs. The old gas lamp, the ordinary carbon arc, and the low-powered incandescent (long strides ahead of the initial installation in London) are now rapidly appearing in the discard. Refinements and improvements in each of the above mentioned types have made possible the introduction of the modern ornamental lighting system.

The value of ornamental street lighting can scarcely be exaggerated. The commercial value to the retail merchant is more than sufficient to warrant his bearing a large portion of the expense. The value to the community lies in the greater convenience and comfort afforded, advantages well worth the cost to the taxpayer. And still another important value is what might be termed advertising or publicity value. A city's streets are its show windows. A live and progressive city, like a live merchant, dresses its show windows well. The constantly increasing stream of visitors to the growing city carries abroad impressions, good or bad, by which that city soon becomes characterized. An unsightly or insufficient lighting system is sure to create an impression of arrested development.

A LESSON TO ENGINEERS AND CITY OFFICIALS.

In a paper before the New England Water Works Association, T. Chalkley Hatton, the engineer who designed and supervised the construction of the Austin dam, which partly failed in January, 1910, and finally collapsed in September, 1911, discusses the reasons for the failure and the factors which influenced the design. The technical features brought out are interesting, but the lesson which the paper should teach to every engineer and to every client of engineers is vital. Mr. Hatton, in a very manly fashion, assumes, in our opinion, more than his share of responsibility. His client's insistence upon certain limitations in cost necessitated a modification of the original plans. Mr. Hatton admits that he made a mistake in not refusing to approve the plans as modified, even though they seemed to allow a reasonable factor of safety. He regrets that he was not accorded the privilege of consultation with at least one other capable engineer.

There is no doubt as to Mr. Hatton's ability as an engineer. He holds a record of many great achievements. His mistake was a common and a natural one. Many an engineer would have done as he did under the same circumstances. The great mistake lay with the owner for whom the dam was built. No important piece of engineering work should be built except upon the concurring advice of at least two capable experts, and no client should insist upon reduction of cost to a point below that which is certainly safe.

THE QUESTION DEPARTMENT

Models of Street Construction in Cities

Can you inform me whether any particular city in the United States or any section of a city is regarded as exemplifying the most advanced type of street construction? I intend to include in this phrase the grade and curvature of cartway and footway surfaces, the formation of gutter and curb, and also the adjustment of sewers, water pipe, conduits, etc., and connections with them from street surface and private property.

E. S. M., Philadelphia, Pa.

Various materials have been developed in various cities so that no one excels in all. In the writer's judgment, Washington, D. C., has the model asphalt streets; Cleveland, O., has the best brick streets; Indianapolis, Ind., the best wooden block streets, altho Minneapolis, Minn., is a close second; Rochester, N. Y., the best sandstone block streets; New York, N. Y., the best granite block streets, if their latest constructions are considered; Providence, R. I., possibly the best bitulithic streets; Richmond, Ind., the most uniformly good macadam streets. As regards the details mentioned, the cities which have the closest control over the sidewalks and the making of connections with the pipes and conduits of public utilities, in general have the best designs, Pittsburgh, Pa., has a good set of standards. The cities of Indiana, most of which follow more or less closely the example of Indianapolis, have good details for level streets. Duluth, Minn., adopted a good set of details for construction of streets and sidewalks on side-hills.

Any of our readers who think their cities should be included in this list are invited to state the reasons for adding them and they will be published.

Regulating Passage of Automobiles Across Sidewalks

The question has arisen in this city as to whether there should be any rules made governing motor cars entering a garage from the street. I am referring, of course, to public garages, which are situated on business streets, and not to those of private individuals in residential districts. I would be greatly obliged, therefore, if you could give me any information on this matter. No doubt some of the large cities on the continent have found some method of dealing with the question.

You will agree that there is always a certain amount of danger where motor cars are allowed to cross at will the sidewalks on busy streets, and it is in order to eliminate this that we are asking for the information.

A. J. LATORNELL,
City Engineer, Edmonton, Alberta.

The city of Cincinnati, O., on September 3, 1912, passed an ordinance "to regulate traffic on and the use of public streets and highways by horses and vehicles of all kinds and by pedestrians," which supplements earlier ordinances and covers most completely the regulation of automobile traffic. With reference to the question asked, it says: "No vehicle shall emerge from an alley, stable or garage at a rate of speed faster than a walk, and when emerging from a garage a proper warning shall be given to passing vehicles and pedestrians. No vehicle shall make any turn at a rate of speed exceeding one-half of the maximum rate allowed by law." It is also provided that "No person in control of a vehicle shall back the same without ample warning having been given, and while backing care must be exercised not to injure those in the rear."

There is but one suggestion offered as to improvement of these provisions, viz: to add the word "enter," so that it will read "No vehicle shall enter or emerge from an alley, stable or garage," etc.

Time for Settlement of Clay Fill

We desire to obtain information as to how soon residences may be built on a fill. We are at present engaged in the development of a tract of land, near Baltimore, on which there is considerable grading. The fills in some instances are as much as sixteen or eighteen feet deep. The houses to be built on these fills will be two and a half story brick, concrete or stone residences, the weight of the walls of which will be about 6,000 pounds per lineal foot. The character of the fill is mostly clay. What we desire to know is:

1. How soon buildings of the above character may be constructed on such fills when the fill is made by team and in layers not to exceed 4 ft. and thoroughly compacted by hauling over same?

2. How soon buildings of the above character may be constructed on such fills when the fill is made by means of steam shovel and cars, the only compacting being that which takes place when the dirt is dumped

from the cars and the compression which is made by the loaded cars running over the fill. THE ROLAND PARK COMPANY,
Baltimore, Md.

The character of the material mentioned is so irregular and its rate and completeness of settlement depend so upon the moisture in it that no definite answer can be made to the questions without full control of all details of handling the materials. It is probable that complete solidity could not be guaranteed under any circumstances, tho it can be approximated quite closely under the best of conditions. Settlement of clay in trenches has been known to take place fully five years after filling.

The safest plan would probably be to place piers on the solid earth and carry them up thru the fill and have weight of the houses carried on these piers. They need not be elaborate or large and would be safe against lateral motion or tipping unless there were danger of slipping of the fill down a side-hill, and would probably be less expensive than repairs in a good house which settled unevenly.

Cities Owning Their Public Utilities

Will you please furnish me with a list of the cities of from 5,000 to 20,000 inhabitants who own their utility plants? I would like to know whether they are operated by steam or water power, and also a comparison of results. Any information on this line will be greatly appreciated.
Y., Mayor, ———, Ga.

The "Municipal Year Book" ($3), published in 1902, gives information as to ownership of public utilities. The "Manual of American Water Works" ($3), published in 1897, gives the detailed information requested, so far as water works were concerned at the date it was issued. The "McGraw Electrical Directory," published semi-annually at $10 a year, gives much of the information desired, as regards light and power plants. Brown's "Directory of American Gas Companies," published annually at $5, gives the data regarding gas plants and the electrical departments, in case companies operate both gas and electric light plants.

Form of Council Record of Ordinance Passage

Will you kindly give me the form for the record showing the minutes of the passage of an ordinance under the laws of Iowa, where a general ordinance is passed at a single meeting of the council of an incorporated town in Iowa? L., ———, Iowa.

Will any of our readers inform our correspondent? Such a form does not happen to be within reach of the writer.

Books on Surveying

This city owns a good surveying transit, but no one to use it. I have assisted in considerable such work, but do not feel competent to risk grade work. Can you inform me of best text-book to secure to enable me to use the instrument and run levels, fix grades, etc.? I have sufficient knowledge of mathematics to make all necessary computations. Please advise also where book may be obtained. K., City Attorney, ———, Ill.

Perhaps the simplest explanation of the processes of leveling and establishing grade lines is given in Staley's Gillespie's "Surveying," first volume ($3.50). The explanations are given in this as in other books on surveying for use with the wye-level, but they can be applied to leveling with the transit, except so far as adjusting the level is concerned. The adjustment of the level on the telescope of the transit is very essential to reasonably good work in leveling with the transit. The method of making the adjustment is given in the description of the transit and its adjustments. The adjustment is one not easy to make by one unfamiliar with instrument work.

Any books named which are in print will be sent by Engineering Publishing Company on receipt of list price.

Municipal Building Restrictions

We would like to know, through your valuable magazine, if any city has restrictions in districts as regards the class of residences to be constructed, or location of such restrictions with reference to the street line; if so, how are these restrictions carried out?

I do not, of course, refer to fire restrictions, but rather to restrictions that might be desired in residential sections, in order to make them desirable residential sections and prevent the location of shacks and unsightly buildings and also in some cases to exclude the erection of business places.
A. J. LATORNELL,
City Engineer, Edmonton, Alberta.

The writer knows of no city in the United States having such restrictions, aside from a few more or less successful attempts to limit the height of buildings by ordinance, some of which have failed and some of which are now in force. It is quite probable that any such restrictions as are commonly made in high-class platted property by the owners thereof, as a condition of the purchase, could not be made by the municipality. Indeed, it has sometimes been found that the original restrictions made upon the first purchasers of property are not binding upon subsequent purchasers of the same property under the conditions surrounding their purchase.

Examples of such legislation must be sought in European countries. Probably the editor of *Town Planning*, a quarterly published by the University of Liverpool, England, could give exact information re-

garding such regulations in England, France and Germany.

Can our readers give any information on this line?

Terms of Electric Light Franchise

This city is about to grant an electric light franchise to a company, and as the matter of getting a proper franchise for the best interests of the city and the patrons of the company rests with myself I am interested in obtaining all the information from the experience of others that I am able to do.

S., City Attorney, ———, Ind.

The franchise for a company furnishing gas, electricity and heat, most of which is quoted in an article on "Franchise for Gas Company," in MUNICIPAL ENGINEERING, vol. xlii, p. 185, is modern and contains some valuable provisions. Reference should be made to that article for the provisions in the sections not quoted below, which are the sections of the franchise referring particularly to electric light:

"Section 1. That the Taylorville Gas and Electric Company, its successors and assigns, is hereby authorized and empowered, and the right, privilege and franchise be and is hereby granted to the said Taylorville Gas and Electric Company, its successors and assigns, to locate, erect, construct, equip and maintain the necessary poles, conduits, wires, cables and other necessary apparatus, appliances and appurtenances requisite and proper for the manufacture and distribution of electricity for the purpose of furnishing light, power and heat to the citizens of the city of Taylorville, and the said city of Taylorville, upon the terms and conditions in this ordinance contained, and subject to such lawful regulations as may hereafter be made by said city by its ordinances from time to time, and subject to the statutes and laws of the State of Illinois now in force or hereafter to be enacted which shall be applicable to the business of the said company and the rights, privileges and franchise by this ordinance granted. Said rights are given in, along, upon, across and over said streets, alleys and public grounds as the same are laid out and established, to-wit: (here follows a list of streets covered by the franchise.)

"Section 4. All poles hereafter erected upon the streets by the Taylorville Gas and Electric Company by virtue of the grants herein shall be as near as practicable of uniform height and size and of first-class material, and shall be smooth shaven and painted with two good coats of paint as soon as placed in position, and the poles of said company now on the streets of said city shall be painted within two years from the passage of this ordinance. And at all times thereafter during the life of this grant such of said poles as are upon or along the streets shall be kept in good condition and shall be repainted at least once in each period of five years thereafter, and of such color as required by the street and alley committee of said city. And shall have such poles of the height and diameter required by the street and alley committee of said city.

"Section 5. All poles, wires, fixtures, conduits and appurtenances and apparatus shall be installed under the direction of the street and alley committee of said city, or person duly authorized by said city, and shall be so placed and maintained as not to materially interfere with the use and occupation of said streets and alleys for the purpose of travel; all poles to be erected within the fire limits of said city shall be of metal, and shall, before being erected, be first approved by the street and alley committee of said city. And no poles shall be erected upon the public square in said city, except for supporting wires and lamps for street lighting purposes at each corner of said square, and all poles, wires or apparatus now owned, operated or controlled by the said Taylorville Gas and Electric Company, for the furnishing of electric current for light, heat and power, located upon the public square in said city, shall be removed from the public square within six months from the date hereof; and all poles and fixtures owned, operated or controlled by said company, of wood or other inflammable material, now situated within the fire limits of said city, shall be replaced with metallic poles within a period of three years from the date hereof. All poles and apparatus of said company now on the streets of said city that are located in gutters and which materially interfere with or obstruct the free flow of the water upon said streets, shall be removed and placed as herein provided within two years from the date hereof; and the said company shall immediately remove all wires in said city which are in an unsafe or dangerous condition and replace the same with a standard grade of insulated wire.

"Provided, that all such poles, wires, fixtures, conduits, appurtenances and all other apparatus, shall not be installed, erected or maintained in such manner as to obstruct or interfere with the use of the property of any other person, persons or corporations, enjoying a like or similar franchise from the city of Taylorville. And all overhead wires erected upon or strung over any of the streets, alleys or public grounds of said city, or private property of the citizens thereof, by virtue of this ordinance, shall be of a standard grade of insulated wire, and

shall at all times be kept in first-class repair, and upon notice from the street and alley committee of the city of Taylorville or other person duly authorized by the city council of said city, any wires, poles, conduits, appurtenances or apparatus upon said streets, alleys or public grounds, which may be deemed unsafe, insecure or dangerous to the public, shall immediately be repaired or replaced and put in a proper and safe condition by said company.

"Section 6. The machinery contained in the plant of said company shall be safe and suitable for the purposes, and the poles, wires, conduits, appliances, fixtures, apparatus and appurtenances installed by the said company upon the streets and alleys of said city, shall be of first-class standard pattern, and all outside wires erected upon or strung along any of the streets, alleys, public grounds or across private property, shall be of standard grade, ample size, and thoroughly insulated, in the most modern and approved manner, and all poles, cross-arms and other fixtures and apparatus of said streets, alleys and public grounds shall be of first-class material and workmanship."

Sections 7 and 8, printed in the article above referred to, give general conditions applicable to all the business of the company, including electric light.

"Section 9. The said Taylorville Gas and Electric Company shall furnish electric current for light, heat and power purposes to all persons living along or upon the streets, alleys or public grounds of said city, occupied by the poles, wires, appurtenances and apparatus of said company, upon proper application being made to said company for such service, by such person, persons, companies or corporations, subject to all proper rules and regulations, as are or shall be adopted by said company, which shall be uniformly applicable to all other persons, companies or corporations, and shall charge the same rates for the same amount of service to all such persons, companies or corporations similarly situated, and under similar circumstances, without discrimination, and shall furnish to such consumer, upon request, a meter, which shall be of the best standard pattern, and all charges computed at the regular rates according to the meter readings, for consumers using meters, and the said company may, at its option, install meters for all consumers not on a flat contract rate.

"The maximum rates and charges for electric current for incandescent lights, arc lights, electric power and heat, to any person, persons, company or corporation making application therefor, as hereinbefore provided, shall not exceed the rates and charges contained in the following schedule:

"a. The maximum meter rate for electric current for incandescent commercial light shall not exceed the price of nine cents per thousand watt-hours (9c per k.w.-hr.)

"b. The maximum rate for electric current for arc lights to private consumers shall not exceed the sum of nine cents per thousand watt-hours (9c per k.w.hr.)

"c. The maximum rate for electric current for power furnished to motors, dynamos and other mechanical purposes to private consumers shall not exceed the price of seven cents per thousand watt-hours (7c per k.w.-hr.)

"Provided, that all motors of one-half horse-power (½-h.p.) or less, used in residences, may be connected with the light current and the said company may charge for the current for the same at the same meter rates as charged for current for lights.

"d. The maximum rate for electric current for heating purposes furnished to private consumers shall not exceed the price of nine cents per thousand watt-hours (9c per k.w.-hr.)

"e. The maximum rate for electric current for commercial incandescent lights upon flat rates and not according to meter, shall not exceed the price of 50 cents per month per light for one sixteen-candle-power light or its equivalent to one consumer, and at the rate of not to exceed 30 cents per month per light to one consumer using four or more of such lamps on the same premises.

"Provided, however, that said company may not be required to furnish meters to parties using less than four lights in the same premises."

Section 10 concerns steam heating rates and section 11 gas rates.

Sections 12, 13 and 14 contain general provisions applicable to all services, section 13 being particularly valuable, as it gives a method of securing revision of rates on application of either city or company. They will be found in the article above referred to.

"Section 15. The said Taylorville Gas and Electric Company shall properly place and maintain, at such heights, points and places as the city council shall designate or select, all the poles, wires, lamps, appurtenances and apparatus necessary for street lighting purposes within a reasonable time after notice from the said city of Taylorville, of such number and character as the city may desire and designate in said notice. And shall furnish to said city for street lighting purposes from twilight until daylight during all the time required by said city of Taylorville during the life of this ordinance, and at not to exceed the following

schedule of prices, viz.: Two thousand candle power inclosed arc lights, not less than ten in number, at the rate of four dollars ($4) per month per lamp; forty candle power incandescent lights, not less than one hundred in number, at a rate not to exceed one dollar ($1) per month per light; and thirty-two candle power incandescent lights, not less than one hundred in number, at the rate of not to exceed eighty cents (80c) per month per light, provided that all incandescent lights required by the said city of Taylorville for street lighting purposes by virtue of this section for any period of time shall be of the same candle power. And any number of sixteen candle power incandescent lights at the same price as charged to consumers in said city. And which said lights or either of them may be required of said company at the option of said city of Taylorville, and shall be furnished by said company upon notice as herein provided.

"Provided, however, that said city shall not require any service from said company as in this section provided for a less period of time than five years, but said city reserves unto itself the right to require such services as herein provided or to contract for street lighting service with said company, or any other person, persons, company or corporation.

"It is further provided that if the said Taylorville Gas and Electric Company shall be furnishing current to the city of Taylorville for street lighting purposes by virtue of a contract, they shall continue to furnish said electric current at the same prices provided in said contract after the expiration of the term of their contract, for a period not to exceed one year or until such time as a contract may be entered into by the city of Taylorville with the Taylorville Gas and Electric Company or other person, persons, company or corporation.

"Provided, further, that said arc lights furnished to the said city of Taylorville shall burn with a steady light and shall at all times be supplied with a current of sufficient power to cause said lamps to burn at the full rated candle power herein provided, and all incandescent lamps shall burn with a steady and uniform light and shall be supplied with current of sufficient power to cause said lamps to burn at the full rated candle power herein provided. And the said city of Taylorville, by its street and alley committee or duly authorized agent, shall have the right to test any and all lights provided for in this ordinance, for the purpose of ascertaining whether or not they are in conformity with the provisions hereof, and for that purpose to enter upon the premises of the said company, and if it shall be found that the service herein provided for is not being given by said company, the said company upon notice thereof shall promptly and as speedily as practicable proceed to bring the lights and current herein provided for up to the standard."

Sections 16, 17, 18 19 and 20 are the sections covering exclusive rights, saving city from damages from construction and operation, default of company in carrying out contract, assignments and term. They are printed in the article above referred to.

Rates for Coal Gas

Our board of city commissioners is anxious to get information regarding the meter rates of coal gas in towns of 10,000 to 50,000 population. Will you kindly inform us where such information can be obtained?

JOHN P. JACKSON.

Rates for gas in most of the cities and towns in the United States will be found in Brown's "American Gas Directory" ($5).

The cost of gas depends so much upon the cost of coal and that so much upon freight charges on coal of proper quality, that a rate cannot be fixed arbitrarily. Process used and amount of gas sold also have an important effect.

The prices allowed in Taylorville, Ill., and the method provided for determining and changing rates are given in MUNICIPAL ENGINEERING, vol. xlii, p. 185.

A series of articles giving rates charged for gas, process used, cost of coal and oil in many cities and towns of 5,000 to 10,000 population will be found in vol. xl, pp. 38, 125, 220, 347.

Modern Street Cleaning Machinery

I am very anxious to find out what is the present state of development of labor-saving street-cleaning machinery, especially such as will work efficiently under the favorable conditions of sheet asphalt pavement. I have noted the account in your present issue of a pick-up hand sweeper. Are there no pick-up horse or motor sweepers? If you know of any I should be much obliged for the makers' names and addresses. If you do not can you tell me where I can find out why various schemes have not worked ?

H. W., ———, N. Y.

Hand, horse and motor street sprinklers, sweepers, flushers and carts are in use for street cleaning. Descriptions of the modern apparatus will be found in MUNICIPAL ENGINEERING, following being a list of recent articles:

Vol. xliii: "A Motor Street Sprinkler," p. 118; "An Original Street Flushing Machine," p. 118; "The Peerless Pick-up Hand Sweeper," p. 125; "A Squeegee Street Washing Machine," p. 192.

Vol. xlii: "Pneumatic Street Cleaning," p. 160, describing the new Furnas motor-driven machine; "Snow Removal

in Indianapolis," p. 260; "Receptacles for Street Sweepings and Washings," p. 445; "The Matchless Sanitary Street Cleaning Machine," p. 492, a man-propelled apparatus.

Vol. xli: "A Foreign Street Sweeping Machine," p. 61, describing a brush machine with pneumatic pick-up; "Street Sprinkling in Denver, Colo.," p. 115; "An Automatic Dump Cart for Street Cleaning," p. 408.

Vol. xl: "Cost and Efficiency of Street Cleaning Methods," p. 32, giving cost of various methods in various cities in some detail; "Railways and Snow Removal," p. 34; "Flushing Streets Under High Pressure," p. 131; "Flushing Street Pavements with Water Under Pressure," p. 132; "Cleaning Streets by Flushing," p. 427, containing also a list of previous articles on street cleaning methods and results.

Attention is called to the German broom sweeper described on p. 235 of the October number. Pick-up sweepers are manufactured by the Briggs Labor-Saving Specialty Co., Waterloo, Ia., Duplex Mill and Manufacturing Co., Springfield, O., H. B. Walker, Tarrytown, N. Y., and a hand apparatus by the Matchless Street Cleaner Co., Troy, N. Y. The Baker Manufacturing Co., Chicago, the National Street Cleaning Co., Spokane, Wash., and the Furnas Street Cleaning Co., Indianapolis, Ind., manufacture modern street sweepers, the latter being a pneumatic machine.

The Austin-Western Co. and the Studebaker Corporation manufacture modern street sweepers and scrapers.

Books on Railway Track Work

Kindly inform me as to what books treat on railway track work, as I would like to get full information on a practical system covering ties, rails, etc., in handling work.

O'D., San Francisco, Cal.

The book probably wanted is Camp's encyclopedic book on "Track" ($3). It is a compendium of practical information on track work in all its details.

Form of Ordinance and Contract for Sewer in Illinois City.

Can you furnish me with a copy of a sewer ordinance and contract? We are contemplating a $15,000 system.

L., City Attorney, ———, Ill.

The improvement laws of Illinois are so complicated and in some respects contradictory that one outside the state hesitates to make recommendations of forms. The National Paving Brick Manufacturers' Association, some four years since, recognizing the difficulties in preparing forms for ordinances and contracts, employed an Illinois attorney to bring as much order out of the existing chaos as possible, and the result is a book of "Forms for Special Assessments, Illinois," which can probably be obtained of the secretary of the organization, Will P. Blair, Locomotive Engineers' building, Cleveland, O. Form 24, in this book, is an ordinance providing for constructing a pipe sewer, paying in instalments, issuing bonds and making special assessments. While the forms in general were prepared with special reference to their use for paving purposes, most of them seem to be equally applicable to other improvements.

Forms 83 to 89 give those necessary in asking for bids, instructions to bidders, form of proposal, form of contract and bond.

Time Required to Connect Telephone Systems

I would like to get some information as to how long it ought to take to make connection between an automatic and manual phone system, between an automatic system having 5,000 subscribers and a manual system having 4,500 subscribers, so that there will be universal service between the two systems.

F., City Attorney, Neb.

This is a question which is beyond the knowledge of any one but an expert who has done the work or who has had an opportunity to inspect the proposed work for the purpose of making an estimate of time and expense required. Can any of our readers give any information on the subject?

Prices of Structural Steel

Please inform me what was the mill price for stock sizes, such as used in highway bridges of structural steel shapes, March, 1905. The present price of same? The average cost of shop work on ordinary truss highway bridges, of span of 40 to 100 feet.

HIGHWAY ENGINEER, ———, Okla.

In March, 1905, the quotations for structural steel in Pittsburg showed 1.60 cents a pound for the smaller sizes of beams, channels and angles, 1.70 for the larger sizes, and 1.65 for Z and T shapes. Tank plates were quoted at 1.50 cents at the mill.

In October, 1912, the corresponding quotations are 1.40 cents for smaller sizes of beams and channels, 1.45 to 1.50 for larger sizes.

Full details of cost of shop work are given in Ketchum's "Design of Highway Bridges" ($4). It varies from ½ cent to 1.3 cents per pound, according to kind of bridge and size, the smaller bridges costing most, and would probably be ¾ to 1 cent a pound for the kind of bridges named.

FROM WORKERS IN THE FIELD

Designing a Street for a Small City

Bicknell is a small city in Indiana having at present a population of four to five thousand, which was not in existence as a municipality in 1900 and is included in the census of 1910 as a town with a population of 2,794. Its development has been rapid within the past five years or so on account of the development of coal mining in its vicinity and it had hardly learned how to conduct itself as an incorporated town when it found itself a city of the fifth class.

Thus far its public improvements have consisted of an electric lighting plant owned by a corporation and some miles of cement sidewalks, some laid to established grades but others difficult to fit to any grade system. This summer the city concluded that conditions required the pavement of the main street and proceedings were started covering its entire length from north to south corporation lines, some 5,800 feet. Some of the details of the design will be of interest to other small cities, as they follow the lines of maximum efficiency at minimum cost.

The width of the street is part 50 and part 45 feet between property lines. The business section of the street between Reid and Fourth streets, about 1,500 feet had sidewalks eight feet wide, which had demonstrated themselves to be too narrow for the traffic upon them for certain hours of almost every day, so that there was strong pressure for an increase in their width. While the traffic on the street itself is not light it can be taken care of on a street paved and kept in good condition and free from obstructions which is wide enough to permit a row of vehicles standing at each curb and space between for the passage of vehicles going in both directions. This was carefully considered by the council and a width of 27 feet was adopted for the street pavement thru this business section of the street. This belief in a street sufficient for the traffic even if it is narrow, is one which is not common, tho, fortunately for the taxpayers as well as for the appearance of the city, its popularity is increasing. Each sidewalk will then be 11.5 feet wide, including the curb. This will relieve the congestion of foot traffic materially, but in the judgment of the storekeepers will still be insufficient to prevent some crowding at times under the local conditions, due to the character and habits of many of the inhabitants.

A good balance has been turned between the demands of users of sidewalks and pavements and each class has been taken care of as completely as possible without encroaching unduly upon the rights of the other.

The residence portions of the street from the ends of the business section to the city limits each way do not require even the 27 feet width of pavement and the width on those sections has been reduced to 22 feet. The principal factors in inducing the council to adopt this width were two, economy, and improvement of the appearance of the street. City blocks are short, being but 254 feet, including a 50-foot street and a 12-foot alley. Therefore, while a 22-foot street is too narrow to turn upon, the streets and alleys are so close together that one need go but a few feet to find room to turn either directly or by backing into the alley wing.

With 5-foot sidewalks this gives 9-foot spaces on each side of the street for lawns and trees and already property owners are planning the improvement of these spaces. Many trees are already in place, and it is probable that the location of these trees had something to do with the location of the curb lines. If the street had been made wider some of these trees would have been destroyed.

In carrying out the wishes of the council the engineers have been careful to locate the crown of the street so that the curbs will be in general below the sidewalks enough to give a gentle slope to the lawn, sufficient to drain walk and lawn. The grades of the existing sidewalks being somewhat irregular, this slope is not uniform, but is not so irregular as to produce an objectionable appearance. Indeed, it is possible that the slight irregularities will enhance rather

than detract from the beauties of the street.

The southern end of the street is but 45 feet wide, so that the lawns on this section are but 6.5 feet wide.

The business section of the street is on the slope of a hill so that on two blocks grades of 3.5 to 4 per cent were found necessary, and one short stretch at the railroad crossing required 5 per cent. To care for the water on this hill and relieve street crossings of the accumulations of water, a drain was planned for the center of the street with inlets at each street corner. The street is located nearly on a ridge and the amount of water draining into it from side streets is very slight, but little exceeding an average width of 100 feet of drainage area each side of the street. This fact makes the drainage of the street in general quite easy and it is taken care of, elsewhere than as noted, by the gutters of the street, being turned into the drainage channels either side at convenient points.

This makes gutters across the intersections of the side streets, except in the business portion of the street, but they will not be seriously objectionable so long as the side streets are not paved, and when they are paved, they will have their own drainage problems, to which these intersections can be added.

On account of the uniformly good grades on the street, but few of them being slight, a crown of 4.5 inches was considered sufficient.

Combined curb and gutter was adopted, reducing the brick surface to 24 and 19 feet width on the two widths of street.

Five-inch portland cement concrete foundation was adopted, mainly because the hill section was rather wet and liable to slide, and the concrete foundation was believed to be safer to hold the pavement in place should the sub-drainage provided by the street drains above described prove insufficient for any excessive water difficulty.

The contract was let on the lowest of four bids at $1.80 a square yard for the brick on 5-inch concrete, 50 cents a linear foot for combined curb and gutter and marginal curb, and 30 cents a cubic yard for grading. The estimated total cost, including the drainage system, is practically $38,000.

According to the system required by the Indiana law, bids were asked on asphalt, concrete and macadam in addition to brick, the estimate on the asphalt being $7,000 more than on brick and that on macadam $14,000 less. Bidders knew that the property owners had already officially expressed themselves as requiring a brick pavement, so they made bids for brick only. The only effect of the law, therefore, was to raise the estimate limit to that for asphalt pavement. Whether this had any effect in increasing the bids on brick above City Engineer E. C. Williamson's estimate is a matter of opinion. The bids did exceed his brick estimate some $3.000.

Chicago Garbage Removal

Editor MUNICIPAL ENGINEERING:

Sir—The Bureau of Streets is one of the eight bureaus which compose the Department of Public Works. The importance and extent of the work in charge of this bureau is indicated in the statement that it recently expended 45.7 per cent of the total annual appropriation to the Department of Public Works for operation and maintenance.

The character and variety of the duties of the bureau as regards the collection and disposition of refuse and garbage are as follows:

(1) Removal of dead animals.

(2) Cleaning of all streets, alleys and public places.

(3) Collection of ashes, garbage and other refuse.

(4) Removal of garbage by boat to reduction plant, Thirty-ninth and Iron streets.

(5) Disposal, by reduction, of garbage at Thirty-ninth and Iron streets.

(6) Disposal, by dumping in clay holes and low lands, of ashes and other refuse.

(7) Removal of snow.

The tank wagons used in the garbage service consist of steel boxes of 4 cubic yards capacity, constructed so they can be lifted off the wagon bed. There are two hundred of these wagons in the service, all owned by the city; forty-three are handled at the Oakley avenue loading station; seventy-one at the Chicago avenue loading station, and eighty-six go direct by team to the reduction plant at Thirty-ninth and the river. During the year 1911 we collected and delivered to the Chicago Reduction Company 117,775 tons of garbage at a total cost of $447,740.47, making the cost per ton $3.80, and the per capita cost 19.8 cents.

We also collected during the year 1,338,200 cubic yards of ashes and rubbish at a total cost of $825,437.67, making the cubic yard cost 61.6 cents, and per capita cost 36.4 cents. We have two hundred and fifty wagons in this service. They are wooden, built to certain specifications and have a capacity of 5 cubic yards. They are not owned by the city. During the winter months ashes and rubbish are used to fill in low streets and alleys in outlying wards; in summer time it is dumped in abandoned clay holes in the outskirts of the city. These wagons make the record show one load per day, regardless of the

weight of the load or the length of haul. The distances covered in getting a load vary from .7 of a mile to 6 miles, and average for thirty wards 2.74 miles. The length of haul to the points of disposal varies from .4 of a mile to 6.4 miles, and averages 2.7 miles for thirty wards. The total distance travelled per team per day varies from 3.5 miles to 16.5 miles and the average for thirty wards is 8.14 miles.

The garbage of the north and west side wards is hauled by the wagons to loading stations at Oakley street and at Chicago avenue, and then transported by boat to the reduction plant at Thirty-ninth and Iron streets. The garbage of the south side wards is taken by wagon direct to the plant.

The collection of a city's refuse differs from most transportation problems in that the material is not simply loaded at one point and delivered to another, but must be picked up bit by bit on a house-to-house visit of the garbage and ash men. The amount of garbage per family is small, so the garbage man must travel, our records show, from .7 of a mile to 6 miles, the distance depending on the density of the population, season of the year, etc., before his load is complete. The element of time in getting a load is a large factor in the cost of the work.

The garbage (the refuse animal and vegetable matter) is separated thruout the city from the ashes and other refuse and kept in a separate receptacle. It is collected separately and conveyed by wagon and boat to the reduction or "rendering" plant at Thirty-ninth and Iron streets. The city has a contract with the Chicago Reduction Company, which operates the above plant, to deliver to it all of the garbage of the city 95 per cent pure, that is, containing only 5 per cent of materials other than animal or vegetable matter, for the sum of $47,500 per year.

The Chicago Reduction Company claims that in order to provide for what they believed would be the maximum amount of garbage they constructed a plant of 500 tons capacity per day. The largest quantity they have received for any one day is 450 tons and the average for the years 1908 and 1909 only 300 tons per day.

CHICAGO GARBAGE REMOVAL.
Wagon Used in Hauling Garbage.

Just now the garbage (which is that portion of the refuse consisting of organic, vegetable and animal matter from kitchens, restaurants, butcher shops, etc.) is disposed of by reducing or "rendering," thereby recovering the grease and utilizing the residue as fertilizer base. The practical operation of the reduction plant had proven in the main satisfactory, altho there have been complaints from those living in the neighborhood of the plant. This method has the economic advantage of recovering a saleable commodity and returning, in part, in the form of fertilizer to the soil what is taken from the soil. But while economy must be observed, it is not the

first consideration in disposing of material which could easily become a menace to health. Furthermore, it has by no means been decided that reduction is the most economical solution of the problem. This method, if the separation is good, has the further advantage that the rubbish and ashes, being free from garbage, have a commercial value.

As before mentioned, the wagons used in the collection of pure garbage have water-tight iron bodies with hinged covers of the same material. The trucks upon which these tanks are carried were made by the Bain Wagon Co., Kenosha, Wis., and are of very strong and durable construction.

The wheels are made with oak hubs, dodged mortised; oak rims and oak or hickory spokes. They are soaked in hot linseed oil and the tires are set hot in the good old-fashioned way.

F. W. SOLEN, Superintendent of Streets,
Chicago, Ill.

A Book on Garbage Destructors

A book on modern destructor practice by W. Francis Goodrich, an English engineer with years of experience in English practice, has been published by a London firm and J. B. Lippincott Company, of Philadelphia.

Beginning with an ironical chapter on some alternative methods of refuse disposal, Mr. Goodrich gives brief general descriptions of representative types of British destructors and systems of charging them. He gives a brief explanation of combining the operation of destructors with sewage pumping and purification works and with electric light and power plants with large tables, giving the general features of all the British works of these classes. He then describes very briefly a few examples of each of the three classes of plants named, giving their individual characteristics, with another table giving data regarding all the plants in the British Isles.

The book then takes up some of the points to be considered in the design of a plant, including site, form of specifications, design and operation of such details as air supply, boilers, chimney, etc., and utilization of residuals. Some statements of foreign and colonial practice are given by countries, and a chapter is devoted to United States and Canadian practice, particular attention being paid to the installations made on English models and American modifications thereof, with a few brief descriptions of other furnaces, concerning which he is very critical.

The book is valuable in bringing the record of practice down to date, and the engineer who is already somewhat familiar with destructor practice will get an idea of the work done in improving practice. It is so evident an advocate of the destructor that the reader will be disposed to doubt somewhat that the author is wholly disinterested. This is hardly fair to him, although it is almost inevitable.

Book for Highway Engineers

A handbook for highway engineers, containing information ordinarily used in the design and construction of roads warranting an expenditure of $5,000 to $30,000 per mile, by Wilson G. Harger, first assistant engineer, and Edmund A. Bonney, division chief draftsman, New York state department of highways, has been published by the McGraw-Hill Book Company, New York, at a price of $3.

Part I, covering 116 pages of this book, gives the theories of design in use in the New York state highway department, as interpreted by the authors, covering grades and alignment, sections, culverts, small span bridges and underdrains, foundations for broken stone roads, top courses, minor points, such as retaining walls, curbs and gutters, guide signs, etc., materials and their testing and specifications. Some Massachusetts and New Jersey standards are given as well as those of New York. There are some twenty-five tables or more of data.

Part II goes into the practice of the survey, design, estimates and construction in chapters describing the survey, office practice, cost data and estimates, notes on construction and details of specifications for materials and workmanship. There are numerous tables in the text, such as stadia reduction, radii and deflections, curve functions, earth work tables, quantities of oil required, quantities of materials required for concrete culverts, covering nearly eighty pages, and the last chapter passes without notice into the tables for conversions of various sorts, squares, cubes, roots and circular functions, trigonometric formulae and functions, natural to five places and trigonometric to six, and logarithms to six places which are usually found in books on surveying, occupying 132 pages. An index of seven pages seems to be ample for its purpose.

Within the limits set by the title given above, and the practice on New York roads, the book is excellent and sets high standards which all state departments should try to reach with such modifications as their local conditions demand for economy as well as utilization of local materials.

MUNICIPAL MATTERS IN COURT

Decision on Street Lighting of Waupaca, Wis.

In a complaint brought before the circuit court of Waupaca county, the Waupaca El. Lt. & Ry. Co. appealed from the disallowance, by the common council of the city of Waupaca, of bills for street lighting during February and March, 1910. In reply, the city stated that, disregarding the terms of the street lighting contract and without obtaining the consent of city, the company had substituted lamps inferior to those called for by the street lighting contract, and the city had refused to accept them as complying with the contract. Through stipulation of the parties these proceedings were withdrawn from the court and brought before the Railroad Commission of Wisconsin. It was agreed that all differences as to the efficiency and commercial value of the street lights under the present contract and the respective liability of the city and company under the contract be left unreservedly to the commission to investigate, settle and adjust.

The contract for street lighting between the petitioning company and respondent city provided for "2,000 candle power arc lights" in return for $6.36 each per month. The term "2,000 candle power arc lights" was used to designate the 9.6 ampere d. c. open arc lamp in use at Waupaca at the time the contract was entered into and continued in use under the contract until the fall of 1904, when the electric company substituted 6.6 ampere a. c. inclosed arcs, which have been operated at 7 amperes since these proceedings were brought before the commission.

The total reproduction cost, present value and cost of operation were ascertained and apportioned between street lighting and all other service. After readjusting the operating expenses so as to eliminate excessive general office salaries and distributing the remainder, it was found that the income from street lighting is barely sufficient to compensate the electric company for the present a. c. inclosed lamps, and considerably below the operating cost of the 9.6 ampere d. c. open lamp.

In comparing the two types of arc lamps the quantity of light produced was not the only element taken into consideration. Qualitative characteristics, such as steadiness of light and uniformity of distribution, although hard to measure, were also considered. Tests made by the commission's engineers showed that the illumination produced along the street by the 9.6 ampere d. c. open arc is about twice the amount produced by the 6.6 ampere a. c. inclosed arc. The opinion of experts, including men on the commission's staff, showed some divergence as to how far the greater steadiness and uniformity of distribution of the 6.6 ampere a.c. inclosed arcs offsets this lack of intensity of illumination.

It was held that when the greater steadiness and uniformity of distribution of the 6.6 ampere a. c. inclosed arcs is taken into consideration, the deficiency for which the company might be responsible is so small and of such character that it cannot be made the subject of monetary damages, particularly in view of the fact that the rates paid by the city for the services involved are barely sufficient to compensate the company for the present a. c. inclosed lamps, and considerably below the operating cost of the 9.6 ampere d. c. open lamps. This deficiency is so small as to come within the limits of a reasonable difference of judgment based on all the facts in the case. It was the finding of the commission that the city of Waupaca, under the circumstances, had not suffered such damage by reason of the substitution of the a. c. inclosed lamps for the d. c. open lamps as to entitle it to claim any reduction from the contract price of the street lighting service furnished it by the Waupaca Electric Light & Railway Co. from the time of the change in the installation of street lamps up to the present time.

Decisions of the Higher Courts of Interest to Municipalities.

Private Water Company Must Install Additional Facilities to Supply Greater Demand. —A private water company, in consideration of a franchise, contracted to furnish water

sufficient for the uses of the city and its inhabitants. It was also agreed that, in addition to the machinery then in use, there should be another station established, capable of delivering not less than 5,000,000 gallons daily into the city, and that, in addition to the reservoir then in use, another reservoir should be constructed. Held, that, the contract having provided that it should run for 30 years, the provisions as to the facilities required were temporary, and not qualifications of defendant's general duty to serve as the exigencies of the future might require, and that it was bound to install facilities to supply an elevated district, which had become populated through the growth of the city. Birmingham Water Works Co. v. City of Birmingham (Ala.) 58 S. R. 204.

Customer Must Pay for Water Stolen by Meter Device—Where a customer of a water company sought to restrain the shutting off of its water, and the water company filed a cross-bill for an accounting for water alleged to have been stolen by the complainant, and the chancellor found that an average of 9,000 gallons a day for twenty-six days a month for a specified period had been misappropriated by means of a meter device, a decree requiring complainant to pay defendant for the amount of water so taken, and enjoining defendant from shutting off the supply, provided complainant complied with defendant's rules, was proper. American Conduit Mfg. Co. v. Kensington Water Co., (Pa.) 83 A. R. 70.

Contractor's Bond Does Not Insure Payment for Coal for Machinery Used—A contractor for the construction of a city water works system gave bond to save harmless the city and its officers and the people of the city against all claims due from the contractor "which may accrue to any person, firm or corporation on account of any labor performed or materials furnished under and by virtue of this contract." Held, that this bond did not insure the payment of coal furnished the contractor for fuel to be used on a dredge in the construction of the water works system. City of Alpena v. Title Guaranty & Surety Co. et al., (Mich.) 134 N. W. R. 23.

Municipality May Condemn Land Outside of City Limits—A municipal corporation, when necessary to do so to obtain a water supply for the use of the town or city, may condemn land, tho situated outside the corporate limits. White v. Town of Romney et al., (W. Va.) S. E. R. 323.

Stamped Notice Upon a Contract Does Not Alter Terms of Contract—Binghamton city charter provides that if any sidewalk be paved by the owner with material other than wood, and, such walk being built for the first time, one-half of the cost of paving shall be paid by the city, but in no case shall the entire cost of the walk exceed $2 per square yard for the purpose of fixing the amount to be paid by it. A property owner applied for the grade and specifications of a sidewalk, and the commissioner of public works stamped on the margin of the application: "This permit is granted upon the express condition that the entire cost of the sidewalk shall not exceed 90 cents per square yard for five-foot wide sidewalk, and $1 per square yard for six-foot wide sidewalk, for the purpose of fixing the amount to be paid by the city. Held, that the stamped notice did not amount to a special contract by the owner with the city reducing the cost of the sidewalk below that provided by section 187 for the purpose of fixing the amount to be paid by the city, in absence of proof that the owner expressly assented thereto; the mere building of the sidewalk by him not implying an assent. Hotchkiss v. City of Binghamton, (N. Y.) 132 N. Y. D. 933.

The Specification "Lake Asphalt" Is Not so Indefinite as to Invalidate the Ordinance—Description of a binder in an ordinance providing for street paving to be made of "lake asphalt, or some other equally good bituminous asphalt binder," was not so vague and uncertain as to render the ordinance invalid, notwithstanding the proof that there were two kinds of lake asphalt which were somewhat different in character. City of Park Ridge v. Wisner, (Ill.) 97 N. E. R. 677.

Land Owned by City in an Adjoining Town Is Liable for Taxation—Land owned by a city in an adjoining town which is not used for reservoir purposes is liable to assessment for taxation by such town. City of Norwalk v. Town of New Canaan, (Conn.) 81 A. R. 1027.

City Liable for Damage From Broken Water Main Only When Water Is Not Shut Off After Due Notice—A city negligently failing to shut off the flow of water in a broken water main is liable only for the damages resulting therefrom, and, where property was flooded and damaged before the city could possibly have been expected to shut off the water, it was not liable for a negligent failure to shut off the water, especially where the owner was negligent in allowing the property to remain where the water would spoil it. Monomoy Co. v. City of New York, (N. Y.) 132 N. Y. S. 438.

Municipal Water Company Must Not Discriminate in Privileges—A water company furnishing water for public use, as a public service corporation having extraordinary privileges, is charged by law with the correlative duty of treating all of the public alike and with an obligation to furnish water to each and every citizen or resident who may have need of it; and the fact that a water works system is owned by a municipal corporation does not change the rule. City of Houston v. Lockwood Inv. Co., (Tex.) 144 S. W. R. 685.

Where An Ordinance May Be Construed

in Two Ways, the Sustaining Construction Will Be Adopted—An ordinance for street paving required the binder to be made of lake asphalt or some other equally good bituminous asphalt binder. A witness testified that lake asphalt, unless fluxed, would not make a proper binder for a top course, and that he would construe the ordinance as requiring pure asphalt, tho all his evidence indicated that he thought that the reasonable presumption from reading the whole ordinance was that the term "lake asphalt binder" meant lake asphalt so treated that it could be used for a top dressing binder. Held, that the ordinance would be so construed under the rule that where two constructions of an ordinance are possible, one of which will render it invalid and the other sustain it, the court will adopt the latter. City of Park Ridge v. Wisner, (Ill.) 97 N. E. R. 677.

Contractor May Have Damages for Enforced Methods More Expensive Than His Own—If a municipal contractor is required to perform portions of the work in a more expensive manner than is required by his contract and the specifications upon which he bid, he can recover his consequent damages. Beckwith v. City of New York, (N. Y.) 133 N. Y. S. 202.

Leakage and Metered Water Bills—A municipality is entitled to compensation for water correctly metered to a consumer, and is in no way interested in what the consumer does with it, and is not responsible for any leaks from the consumer's pipes. Where a user of water agrees with a city to a meter measure, the meter readings are presumptively correct, and the user, on an issue as to the amount of water furnished, has the burden of showing that the city's charge is incorrect. Where a user of water fails or refuses to pay past-due water charges, a city, under the authority of ordinance, may shut off the user's water supply; but such a regulation cannot make the city the judge of its own case or justify the shutting off of water to enforce the payment of disputed bills. Spaulding Mfg. Co. v. Grinnell, (Iowa) 136 N. W. 650.

City Liable for Damage Due to Ill-Advised Effort to Abate Damage—Where a servant of a city, in attempting to remove an obstruction in a sewer which caused the flooding of plaintiff's cellar, tried to force water through the sewer, and thus increased the amount of water in plaintiff's cellar, the city was liable for his negligent act. Board of Councilmen of City of Frankfort v. Buttiner, (Ky.) 143 S. W. R., 410.

City Must Make Safe the Space Between the Curb and Property Lines. It is the duty of a municipal corporation to keep the space between the curb and the property line in a reasonably safe condition. Riley v. Kansas City (Mo.) 143 S. W. R. 541.

Nuisance or Negligence Must Be Proven to Recover Discharge of Sewage By a City.—One seeking to recover damages to his farm and place of residence and for personal inconvenience occasioned by the operation of a sewer system for a city, whereby refuse matter is discharged a mile or more from his residence, must allege and prove either negligence in the construction and operation of the system, or that it is a nuisance, public or private. Stamford Sewerage Co. et al. v. Austin (Tex.) 143 S. W. R. 649.

Damages Caused By Original Grade of Streets Cannot Be Recovered.—Damages cannot be recovered from a city for injuries to private property caused by casting surface water thereon by the original grading of streets and alleys; the statutes authorizing payment of damages for injuries caused by grading a street, expressly providing that the section shall not apply to the original grading of a street. Wood v. City of Tacoma (Wash.) 119 P. R. 859.

City May Be Reimbursed for Damages Paid to Individual and Caused By Negligence of Contractor.—Defendants were subcontractors for sewers for plaintiff city, under a contract to do the work according to the original contract with the city, which provided that its engineer should locate the place where ditches should be cut across the sidewalks to accommodate lateral sewers. The city engineer mistakenly directed that a ditch be cut across a sidewalk at a certain place; but, after it was cut by defendants, they and the engineer discovered the mistake, and he directed defendant not to fill the ditch that night, but to make a plank walk across it for use of pedestrians, though he did not direct the manner of constructing the walk or see it done, leaving that to defendant's judgment, and it was negligently constructed by defendants, resulting in injuries to a pedestrian who recovered damages against the city. Held, that, as the injuries were caused by defendants' negligence, the city could, by way of indemnity, recover from them the amount it paid to satisfy the judgment against it for injuries.—Robertson et al. v. City of Paducah (Ky.) 142 S. W. R. 370.

Where a city bought pumps warranted to lift a certain amount of water per minute with the expenditure of a certain amount of power, and the pumps delivered required a greater power, causing an increased expense, it was not bound to accept and pay for them.

Where a city bought pumping apparatus under a warranty that the pumps would do certain work, and made every possible effort, but without success, in conjunction with the seller's agent, to make the pumps do the work as contracted, and where it offered to return the apparatus which at the time of suit it held merely at the seller's order, it was not estopped to dispute the seller's claim for payment of the purchase price, or to deny that it had accepted the apparatus and thereby waived its right to rely upon the warranty. Montague Compressed Air Co. v. City of Fulton et al. (Mo.) 148 S. W. R. 422.

CIVIC BEAUTY

EDITED BY MYRON H. WEST

Efficient Boulevard Lighting

The use of concrete in forming electroliers for street lighting is a comparatively recent practice, but has, nevertheless, resulted in several exceedingly artistic and practical examples, none more so, perhaps, than the installation in the Lincoln Park system of Chicago.

These posts are the result of experiments carried on by Myron H. West while general superintendent of the system, and have received well-earned praise by electrical engineers and municipal officials, not only in the United States, but abroad.

The chief characteristic of the post is its exterior finish and the successful way it withstands weathering, which in so many cases results in hair cracks in the cement and the gradual breaking up of the exterior surface. This is obviated in the case of these posts by a dense waterproofed mixture of special aggregate and cement used as a veneer with which the post is covered.

The posts are finished in red or gray granite screened to uniform size, the cement for the veneer coat being a special white portland. The post is thoroly washed with muriatic acid to etch away the cement and cause the aggregate to appear clean and clear of the usual muddy colored film of mortar.

EFFICIENT BOULEVARD LIGHTING.
Lake Shore Drive, Chicago, showing Concrete Electroliers spaced one hundred feet apart in parellel.

The posts cast in one piece, including the foundation, are thoroly reinforced and carry a two-inch pipe conduit for wiring. A special bronze grill surmounts the shaft and supports a twenty-inch opalescent globe.

The lighting is provided by means of a special arc lamp supported by a frame, or

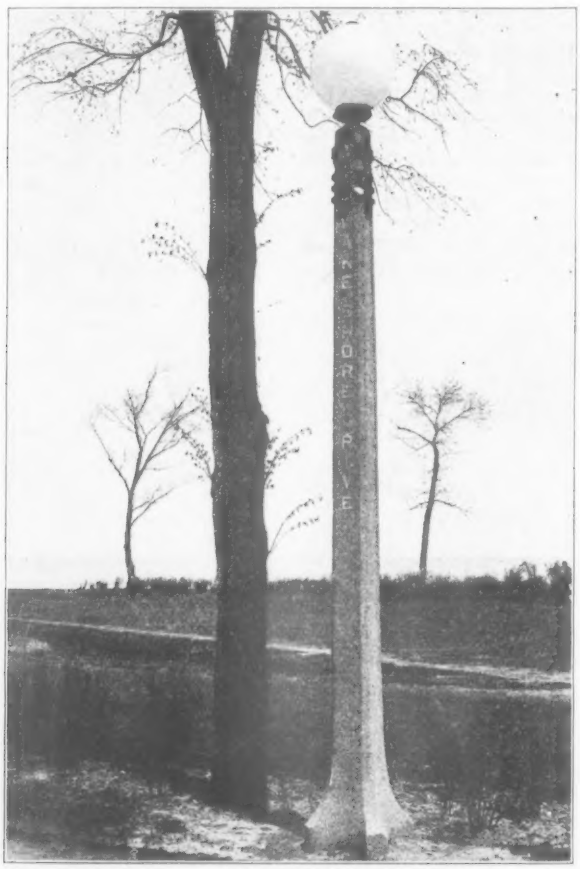
in some cases by clusters or by a single high power filament lamp. The extreme practicability of the post is brought about by its economy of maintenance as well as of first cost, as the post once set up is practically indestructible and really becomes more attractive as age tends to mellow the color.

The post measures fourteen feet from ground line to center of globe, the foundation being four feet. The top of the shaft measures nine inches square with chamfered corners, enlarging to twenty-two inches at the flanged base. The inner core of the concrete is reinforced with four three-quarter-inch corrugated bars, besides the pipe conduit, which leads from the foundation eighteen inches below the ground line.

Great care must be exercised in casting the post, placing the veneer while the core is still wet and taking precaution to allow the work to season before disturbing.

The quiet gray of the granite textured concrete, together with the weather tarnished cap, forms a color scheme which even heightens the artistic effect brought about by the dignified simplicity of the design.

Although costing slightly more than many of the cheaper cast iron or sheet metal posts on the market, this post can-



EFFICIENT BOULEVARD LIGHTING.
A Sample Post Showing Method of Inserting Street Signs by means of employing Bronze Letters set in the concrete.

not but appeal to those who wish to dignify the streets of their city by lighting which is truly ornamental.

City Light in Seattle

The report of the lighting department of Seattle, Wash., for 1911 presents a popular description of the plant and its achievements, with statements of cost of construc-

tion and operation, and a technical description of the entire municipal plant.

The mechanical execution of the report is exceptionally good, the photographs of men, and of details of plant and service, and the drawing and records showing the efficiency of the service are numerous, clear and readily understood, and are arranged and printed in artistic and attractive style. The whole publication reflects credit upon R. H. Thompson, city engineer; J. D. Ross, superintendent of lighting, and the others connected with its preparation and issue.

The plant was begun in 1902, first furnished light in 1904, and the street lighting system was attached to the plant in 1905. The expenditure of nearly $5,000,000 on the plant has been authorized, of which $867,643 showed on the construction ledger in the report for 1905, and $3,614,713 showed in the assets at the end of 1911, but $2,240,000 of the authorized bonds being outstanding. The surplus revenues available for extension and new construction have increased each year from $20,717 in 1908 to $153,434 in 1911, showing that the extensions are more than paying for themselves.

For residence lighting, rates vary from 7 to 4 cents, according to quantity; for business lighting, 8 to 1½ cents; for power, from 7 to 0.6 cents, according to connected loads. Certainly very reasonable rates.

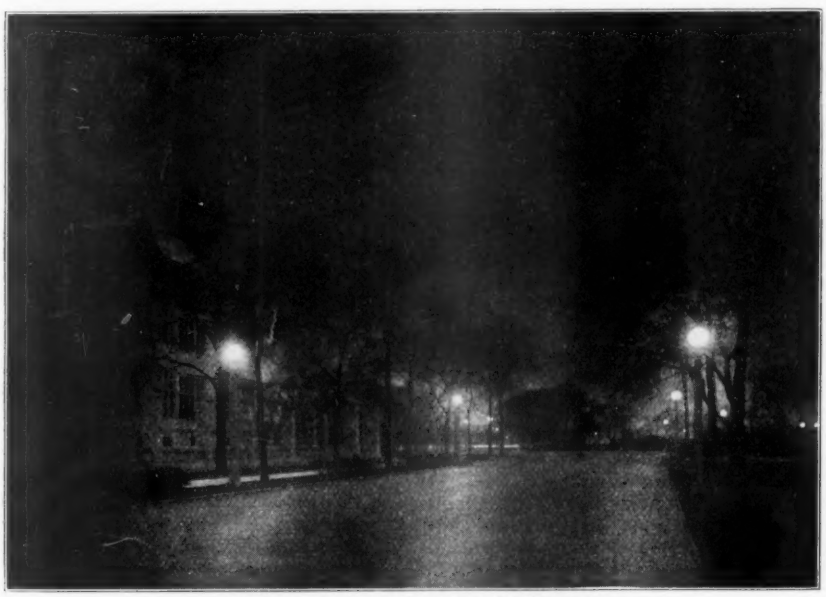
The report presents figures in considerable detail with the expressed purpose of refuting numerous charges that the plant was a failure, could not meet its expenses and must be an expense to the taxpayers. There is no apparent attempt to gloss over mistakes or conceal information, and the reader can draw his own conclusions and will doubtless agree with the report in them.

Building Parks from Drainage Canal Sludge

The Chicago Sanitary District trustees have let a contract for dredging the deposits in the drainage canal, primarily to restore it to its full efficiency of discharge. It is estimated that 1,500,000 cubic yards of sludge will be removed. If dumped in the lake, it is liable to polute the water supply, especially since the federal regulations require that it be towed eight miles into the lake before dumping.

The Lincoln Park Board has invited the Drainage Board to dump the material in the area which it wishes to fill in for use for park purposes along the north shore, between Cornelia and Devon avenues, and the contract for the excavation and dredging of the canal calls for this disposition of the earth and sludge.

The material is excellent for the purpose, and out of the slime of the drainage canal will arise one of the finest parkways in the city.



EFFICIENT BOULEVARD LIGHTING.
Lake Shore Drive, Chicago, by Night.

SEWERS AND SEWAGE DISPOSAL

Properly Built Flush Tanks

All engineers recognize the necessity of keeping a sewer system clean as a sanitary measure. No matter how well a sewer system may be designed and constructed it will not satisfactorily serve its purpose if any deposit or accumulation of decomposing matter is allowed to occur. It does not pay to wait until actual stoppage takes place. The system should be kept clean from the start and experience has shown that this can only be done by periodic flushing either by hand or by automatic flush tanks.

Hand flushing can only be depended upon when in charge of responsible, intelligent and untiring care-takers.

Automatic flush tanks can always be depended upon to do their duty if engineers will only give sufficient thought to the matter to select a simple, reliable, efficient and durable siphon. They should be careful as to capacity, according to the size and grade of the sewer and length of line to be flushed. They should be properly constructed and made watertight. Necessary instructions should be given to the authorities having in charge the maintenance of the sewer system as to their proper handling and the amount of water to be used.

A flushing apparatus may apparently work under all conditions, discharge at a very rapid rate, and continue to give perfect service for several months, and in some cases a year or more, but if, sooner or later, this apparatus ceases to do its proper work, it will either have to be repaired, or replaced by another at great expense to the users. Durability depends upon simplicity of construction, absence of moving parts and subsidiary devices.

In excavating for the cistern, enough earth should be removed to allow a space of 6 inches all around outside of the wall. After the excavation is made the siphon trap should be placed in position, put vertical both ways, and then secured in position by concrete. The bell should then be placed in its proper position to prevent mortar or debris from falling into the siphon. The connection with the sewer should then be made. The walls should then be built and with sufficient footings; the bottom of the cistern afterwards. The walls should be built of hard burned brick and laid in full joints of cement mortar. No lime whatever should be allowed on the job. Both the walls and the bottom of the tank should be thoroly plastered, both inside and out, with cement mortar ½ inch in thickness. After hardening of the plaster, but before it has become fully dry, the walls and bottom of the tank should be coated with pure cement slush applied with a brush so as to make the work absolutely watertight.

The feed pipe should be inserted at its proper place and built in the wall at the time of construction, and should be fitted with suitable brass cock and regulator for controlling the rate of supply to the flush tank. The vent pipe should enter the tank above the high water line. The excavation around the cistern should be thoroly filled and tamped with earth to the surface of the street, and if any sodded, graveled, macadamized or paved surface was removed in excavation, the same should be restored to its former condition.

The tank should be swept clean, the trap of the siphon filled with water, and the bell again placed in position.

Considerable publicity has been given to the matter of water waste in the city of Memphis. We have personally investigated the conditions at Memphis and find that while a considerable amount of the total waste reported was caused by leaky flush-tanks, at the same time, the part of the flush tank that occasioned the leak was simply the ordinary black-iron pipe used to connect the water from the main to the flush tanks, which completely rusted out. Some of the stop-cocks were also clogged, owing to the pressure of iron in the water.

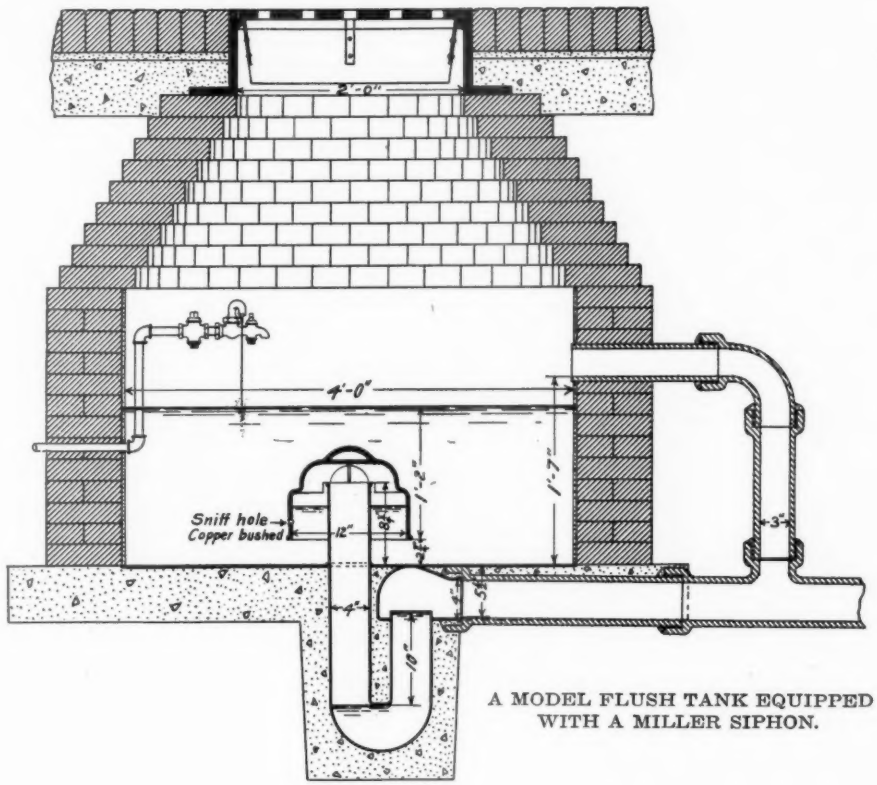
Mr. J. H. Weatherford, city engineer of the city of Memphis, states: "Inasmuch as the report is being circulated that this waste is on account of the siphons, I am writing to advise that the waste is not in any way connected with the siphons but is caused solely by leaky connections from

the water mains to the flush tanks. Those conections were put in years ago of common black-pipe and have rusted out and are being replaced, wherever found, with lead pipe, but those that have not been replaced are in a great many instances leaking badly. This is certainly no fault of the flush tanks themselves or of the siphons in the tanks and any statement to this effect is absolutely false."

Assuming that an ordinary flush tank is operated once in twenty-four hours, the average water cost is about one cent for each flush, yet many flush tanks in use are flushing every thirty minutes and wasting enormous quantities of water. This great waste can be entirely eliminated if the tank is occasionally inspected and by using a proper regulating device to control the supply. They are on the market and will save their cost in from three to six months. But even with a proper regulator, water may be wasted if the flush tank construction is faulty and permits water to leak out as fast as it comes into the tank. Several cases of this kind have developed where the water leaked out thru the masonry as fast as it came in, and yet the flush tank, or more properly the siphon, is frequently blamed for this defect.

Flush tanks may be equipped with a proper regulator but if the pipe connections are leaky or old rusty pipe is used that soon develops leaks, the regulator obviously cannot help the conditions. The safest way and cheapest way is to build the tank absolutely tight and supply the water thru a regulator connected up to the water supply thru lead or lead-lined pipe, or at least with new galvanized pipe, and common wrought black pipe should never be used.

When flush tanks are built and siphons are set by those unfamiliar with them, use blue prints showing proper way to set siphons and specifications should be obtained from the maker.



A MODEL FLUSH TANK EQUIPPED WITH A MILLER SIPHON.

A Miller two-piece siphon as originally constructed, set twenty years ago, is still operating every twelve hours. This siphon is inspected at regular intervals but has never needed repairs. If sewers need flushing (and that they do in parts of nearly every system is conceded) the cheapest and best way to accomplish the result is by means of flush tanks built properly.

ORGANIZATIONS & INDIVIDUALS

The American Highway Association

That the movement for a better system of highways in the United States has been greatly advanced by the American Road Congress held in Atlantic City, September 30 to October 5, was the assertion of all the directors of the American Association for Highway Improvement at the meeting held in Atlantic City at the conclusion of the 1912 American Road Congress.

For the sake of convenience, the title of the American Association for Highway Improvement, now entering its third successful year, was changed at the annual meeting to the American Highway Association, as it will be henceforth known. Logan Waller Page, director of the United States Office of Public Roads, was re-elected president of the association. W. W. Finley, president of the Southern Railway Company, was elected vice-president in place of W. C. Brown, president of the New York Central lines. J. E. Pennybacker was re-elected secretary, and Chas. P. Light was re-elected organizer and field secretary. Lee McClung, treasurer of the United States, continues as treasurer of the American Highway Association.

The newly elected directors of the association are James H. MacDonald, state highway commissioner of Connecticut; George W. Cooley, state highway engineer of Minnesota; A. G. Batchelder, chairman executive committee of the American Automobile Association; C. A. Kenyon, president of the Indiana Good Roads Association, and Dr. Joseph Hyde Pratt, state geologist of North Carolina.

The greatest satisfaction was expressed by the directors of the American Highway Association, not only over the great growth of the association itself, now having more than forty state and interstate road associations affiliated with it, but over the fact that the American Road Congress, which consolidated the conventions of the American Highway Association, the American Automobile Association and the National Association of Road Material and Machinery Manufacturers, was by far the greatest road convention ever held.

Fifty states and countries were represented at the congress, while twenty-four highway commissioners participated in deliberations. The government of France was represented by M. de Pulligny, chief engineer of bridges and highways; Canada, by Minister Caron, of the department of agriculture and roads, of Quebec; the corps of engineers of the United States army, by Col. Spencer Cosby. The exhibit at the congress was the largest ever made at any road convention in the world, even surpassing the exhibit at the International Congress held in Brussels in 1910.

The Dallas Convention of the American Society of Municipal Improvement.

The American Society of Municipal Improvement will hold its next convention in Dallas, Tex., November 12 to 15. Arrangements have been made for the northern and eastern members to leave St. Louis over the Missouri, Kansas and Texas railroad on the morning of Sunday, November 10, on a special train, which will arrive in Dallas about noon on Monday, November 11.

Those wishing to go on this train should notify President E. A. Kingsley, Little Rock, Ark., at once.

The meetings of the committee on standard specifications will begin on Monday afternoon, and the meeting of the executive committee will be held on Monday evening. The program has not been announced up to the date of going to press, but it is always good.

Dallas is a city of 111,000 population which has had a very substantial development in its life and growth of sixty years.

The city has many municipal improvements of good quality, both as to design and construction. They include over 100 miles of pavements of all the standard kinds and 168 miles of water mains with the necessary reservoirs and artesian wells into three separate strata of under-

ground water. Plans are under way for a filtration plant for the surface water supply which the city is also required to use. There are 161 miles of sanitary sewers, and bonds have been voted for a sewage disposal plant. The city is specially rich in parks and playgrounds. More than half the city's improvements, including also its sidewalks, street car lines, viaduct and lighting system, have been constructed in the past seven years.

Hotel accommodations are ample, the latest, just opening, being twenty-two stories high.

The city has two cement factories and uses much of this material in its work, the latest large structure being a reinforced concrete viaduct, 5, 840 feet long and the full width of the street.

The decorative lighting on Elm, Main and Commerce streets is an attractive feature. Magnetite lamps are placed on each side of the street each 75 feet.

Those from the east of the Mississippi river can get special winter tourist rates, and for but a little more can purchase round trip tickets to Houston via Dallas, and thus be able to see both Houston and Galveston.

The American Road Builders Association

No question is of more vital importance to the American people that that of highway improvement. Interest in the subject is already widespread, and is daily becoming more intelligent. The American Road Builders' Association is endeavoring to emphasize the importance of expending the funds appropriated for highway improvement to the best possible advantage. The sum annually expended for road construction and maintenance is enormous, and it must be admitted that a very considerable proportion of it is used to poor advantage, if not actually wasted. Lack of foresight in the laying out of a rational and comprehensive system of highways for improvement; blunders in the selection of the type of road surface best fitted for the traffic to be accommodated, and the topographical and climatic conditions; failure to use to advantage local materials which, in proportion to their cost, will give better service than those transported great distances at correspondingly great expense; lack of appreciation of the value of cost data both for construction and repairs; inefficient organization and ignorance of the fundamental principles of economical maintenance—all these are exacting a heavy toll from the people of the western continent.

The ninth annual convention of this association will bring together in a great national body some of the foremost road building and paving experts in the United States and Canada. These men will meet for the purpose of discussing the many problems connected with highway and street improvement. To this have been invited all the highway officials in each state of the United States and the provinces of Canada, the city, county, and township officials, contractors, engineers, superintendents, governors of states, legislators, freeholders, farmers, automobilists and, in fact, everyone interested in the subject.

The aims and objects of the association stated briefly are as follows:

First, to unite in a national organization all those in the United States and the provinces of Canada who are actively engaged in laying out or supervising the work of construction and the maintenance of roads and streets, and all others especially interested in highway improvement.

Second, to carry on a campaign of education among its members, and thereby raise the standard of road building and street paving.

Third, at its conventions to devote its sessions primarily to the presentation of papers and to discussions on the practical questions connected with the design, construction and maintenance of rural and urban highways.

Technical Associations

Col. John A. Ockerson delivered an illustrated address on October 16 before the Engineers' Club of St. Louis on "The Colorado River Delta and the Salton Sea."

The American Society of Engineer Draftsmen at its annual meeting in New York, October 1, elected the following officers for the year 1913: Prof. Charles W. Weick, Columbia University, president; W. B. Harsel, first vice president; C. A. Clark, second vice president; C. B. J. McManus, third vice president; L. T. Maenner fourth vice president; Walter M. Smyth, secretary; Erwin C. Meyer, treasurer.

A joint meeting of the Engineers' Club of Philadelphia and the Philadelphia Chapter of the American Society of Mechanical Engineers was held on October 5. A. R. McBride, of Pittsburgh, read a paper entitled "Methods and Means of Smoke Abatement," and George H. Perkins discussed the International Smoke Abatement Exhibition held in London last April.

At a meeting at Grand Forks, in response to a call issued by Mayor M. F. Murphy, the North Dakota Municipal League was formed. The following officers were elected: President, M. F. Murphy, Grand Forks; Vice president, A. Bowers, Fargo; secretary, Charles Evanson, Grand Forks.

At a meeting of the Brooklyn Engineers' Club on October 10, a paper was presented by John B. Stein on "The Topographical Bureau of the Borough of Brooklyn, City of New York."

The officers elected at the recent annual convention of the International Association for the Prevention of Smoke are as follows: President, J. P. Brown, city smoke inspector, Indianapolis, Ind.; vice president, J. M. Searles, Pittsburgh, Pa.; secretary and treasurer, John Krause, city treasurer, Cleveland, O.

At the meeting of the American Society of Civil Engineers on October 16, the following papers were presented for discussion: "A Brief Description of a Modern Street Railway Track Construction," by A. C. Polk, and "Construction of a High-Service Reservoir at Baltimore, Md.," by P. A. Beatty.

At a meeting of the Associated Engineering Societies of St. Louis, on October 2, held under the auspices of the St. Louis Association, A. S. C. E., a paper was presented by Carl Gayler, on "The Reinforced Concrete Column."

On October 11-14, an inspection trip was made by the Maine Society of Civil Engineers to the new Aziscohos dam on the Magalloway river, Lincoln Plantation, Me., and a regular meeting of the society was held at the dam on October 12.

At a regular meeting of the Municipal Engineers of the City of New York, held on October 23, a paper on "The Fourth Avenue Subway, Brooklyn," was presented by H. A. Oestreich, M. M. E., N. Y., senior assistant division engineer, Public Service Commission.

Secretary A. D. V. Storey, of the Fire Exposition and International Conference of Fire Prevention, Protection and Extinguishment, 1269 Broadway, New York, has issued a circular letter giving the reasons why the meeting was postponed until December. A general desire was expressed by the prospective exhibitors to postpone the exhibition until after the national election. Moreover, owing to the proximity of the date to that of the Denver convention of the International Association of Fire Engineers, leading manufacturers found it impossible to exhibit as much apparatus as they would like.

U. S. Civil Service

The civil service commission will hold examinations as follows:

November 6, 7, 8. Draftsmen (Marine Engines and Machinery), Bureau of Lighthouses; Washington, D. C., $1,300; Tompkinsville, N. Y., $1,500; Division of Revenue Cutter Service, Treasury Department, $1,400.

November 8. Mineral Technologist, field service, Denver, Colo., $3,000 per annum.

November 9. Mine Sanitary Engineer, field service, $1,800 to $2,400 per annum.

November 11. Mechanical Draftsman, Milwaukee, Wis., $900 per annum.

November 20, 21. Heating and Ventilating Draftsman, office of Supervising Architect, Treasury Department, Washington, D. C., $1,200 per annum.

Technical Schools

Prof. E. C. Schmidt, who is in charge of the department of railway engineering of the University of Illinois, has been commissioned by the Japanese government to design a dynamometer car for the Imperial Government Railways. It will be constructed in this country.

Frank B. Moody, assistant state forester of Wisconsin, has been appointed assistant professor of forestry at the University of Wisconsin, at Madison. Prof. Moody is a graduate of the forestry school of the University of Michigan.

Robert M. Black, M. Am. Inst. M. E., formerly instructor in civil engineering at the State University of Iowa, has been appointed assistant professor of mining at the University of Pittsburgh.

Col. R. A. Marr, who has been for the past seven years dean of the engineering department of the Virginia Polytechnic Institute, also occupying the chair of civil engineering, has resigned in order to give his whole time to consulting practice. He will be located in Richmond after November 15.

Wood Block Paving in St. Louis—A Correction

Attention has been called to a statement in the article in the October number of MUNICIPAL ENGINEERING, with the above title, which appears in the first paragraph in the second column on page 266. The correct statement is that "the actual expenditure on 50,000 square yards of yellow pine creosoted wood blocks laid on streets in St. Louis in 1903 has been less than two-tenths of a cent per square yard for up-keep for the entire life of the pavements, to the end of 1911."

Mr. Travilla's figures in the table on the same page show that the total expenditures for 1911 for up-keep were but $28.96, or about 0.05 cent a square yard, too small to consider on the yardage basis.

Calendar of Technical Meetings

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENT—Annual Convention, Dallas, Tex., November 12-15. A. Prescott Folwell, secretary, 50 Union Square, New York City.

AMERICAN CIVIC ASSOCIATION— Annual Convention, Baltimore, Md., November 19-22. Richard B. Watrous, secretary, Union Trust Building, Washington D. C.

FIRE EXPOSITION AND INTERNATIONAL CONFERENCE OF FIRE PREVENTION, PROTECTION AND EXTINGUISHMENT—Madison Square Garden, New York City, December —. A. D. V. Storey, Secretary, 1269 Broadway, New York City.

AMERICAN ROAD BUILDERS' ASSOCIATION—Ninth Annual Convention, Music Hall, Cincinnati, O., December 3-6. E. L. Powers, secretary, 150 Nassau street, New York City.

NATIONAL SOCIETY FOR THE PROMOTION OF INDUSTRIAL EDUCATION —Annual Convention, Philidelphia, Pa., December 5-7. C. A. Prosser, secretary, 105 E. 22d street, New York City.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS—Annual Meeting, New York City, December 9-12. Percy H. Wilson, secretary, Land Title building, Philidelphia, Pa.

NATIONAL ASSOCIATION OF CEMENT USERS—Annual Convention, Pittsburgh, Pa., December 12-18. R. L. Humphrey, president, Harrison building, Philadelphia, Pa.

Personal Notes

James H. Stone, city engineer of Franklin, N. H., has resigned.

M. D. Martin has been appointed superintendent of water works of Clayton, Ala.

William K. Kavanaugh, of St. Louis, has been re-elected president of the Lakes-to-the-Gulf Deep Waterway Association.

John A. Bensel has been renominated for the office of New York state engineer and surveyor on the Democratic ticket.

A. L. Gilmore, civil and landscape engineer, of Binghamton, N. Y., has been appointed resident engineer for the Binghamton Paving Brick Company.

C. A. Tupper, consulting engineer of Milwaukee, Wis., has been appointed a member of the civic committee to investigate the paving conditions of the city.

Henry S. Brinker, of South Bethlehem, Pa., president of Lehigh University, has been appointed a member of the executive committee of the new Water Conservation Commission of Pennsylvania.

L. C. Whittemore has resigned as assistant engineer with the Board of Water Supply of New York City, to accept an appointment as resident engineer with the Sanitary District of Chicago.

W. R. Haynie has been appointed American representative of Carels Freres, Ghent, Belgium, manufacturers of the Carels-Diesel oil burning marine engine. Mr. Haynie has his office in the Hudson Terminal Building, New York.

Kern Dodge, engineer, of Philadelphia, announces the opening of an office in the Morris building, where he will devote himself to the engineering and financing of public service properties. Mr. Dodge was one of the founders of the engineering firm of Dodge & Day.

Willis J. Dean, civil and structural engineer, has opened an office in the Timken building, San Diego, Cal. He was formerly connected with James Stewart & Co., general contractors, of New York, in charge of their office at Portland, Ore., and also occupied the position of state structural engineer of Oregon.

Major W. W. Crosby, consulting engineer, announces the removal of his offices to 1431 Munsey building, southeast corner of Fayette and Calvert streets, Baltimore, Md., where his practice will include engineering administration, arbitration, efficiency and organization, landscape, park and development work, municipal planning, road and street specifications and testing of paving materials, both chemical and mechanical.

W. E. Atkinson has been appointed chief engineer of the State Highway Department of Louisiana. The work of this department has been formerly in the hands of the State Board of Engineers under the direction of Mr. Gervais Lombard, one of the assistant state engineers, who has also been in charge of levees. In connection with the present appointment, the highway work becomes established in a separate department, though still under the supervision of the State Board of Engineers. Mr. Atkinson is a graduate of Louisiana State University in the class of 1900.

MACHINERY AND TRADE

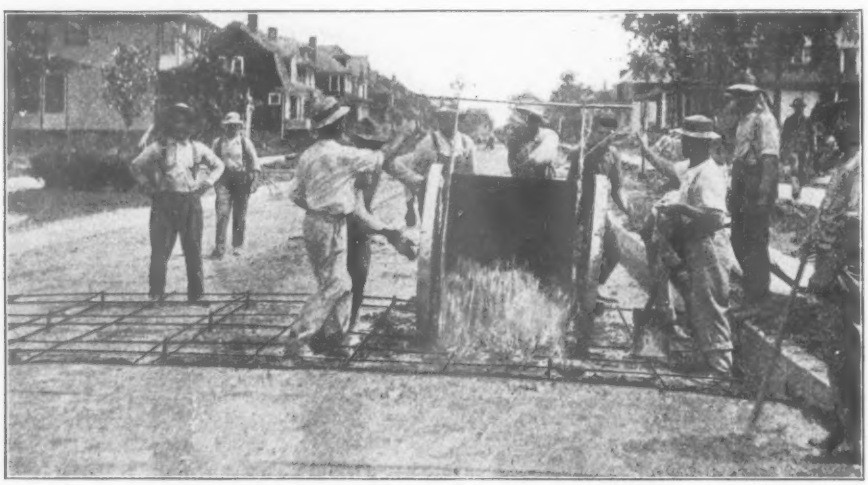
Thomas Steel Reinforcing for Pavements

BY C. G. ALLEN, BUREAU OF ENGINEERING, CHICAGO, ILL.

Concrete road construction has been advancing in favor with a rapidity not generally appreciated. It is no longer new, and the experience with it up to the present time has been largely localized but most county and municipal engineers are willing to give this type of construction a trial when definite information regarding service is furnished. Experience in Wayne county, Mich., and elsewhere has been gained thru a period of sufficient length to warrant the statement that well built concrete roads and pavements are a usual form of construction which merit more extensive adoption. Plain concrete, owing to its inherent tendency to shrinkage during process of hardening, and with the expansion and contraction under different ranges of temperature, will develop cracks in its mass. The tendency to crack is obviated by the proper and scientific distribution of the steel thru the whole mass.

Considerable attention has, of late been directed to the Thomas steel reinforcement for pavements. This system is simple and practical. In it the proper percentage of steel has been properly distributed.

Another phase of the Thomas steel reinforcement, which is made in units, is that it eliminates the personal equation as nearly as can be when the placing of steel reinforcing in concrete pavements is concerned. No part of the reinforcement can be forgotten or omitted, as the frames are made up in the shop and are delivered as a unit.



REINFORCING CONCRETE PAVEMENTS.
The Reinforcement in Place.

The Thomas steel reinforcement is placed in the following manner: The ⅜-inch round steel bars are placed longitudinally and crossways 2 feet center to center and 1 inch from the top surface of the finished concrete. The ¼-inch round steel bars are placed longitudinally and crossways 4 feet center to center and 4 inches from the top surface of the finished concrete, and both systems are well

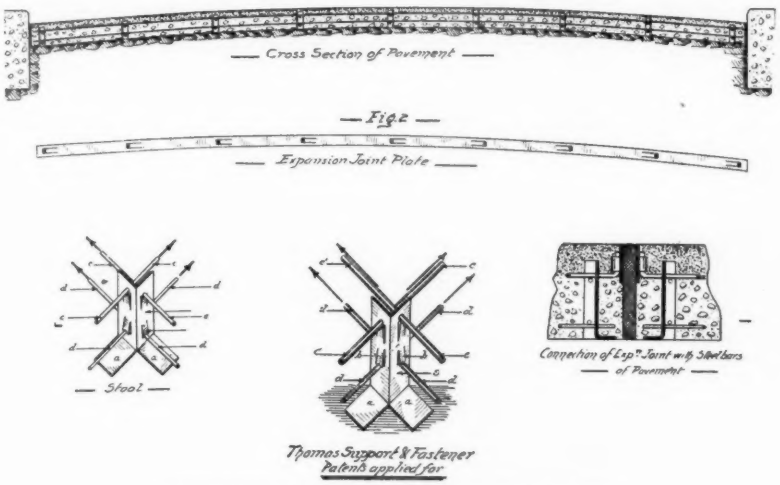
clamped together at their intersections. The two systems are properly supported in their respective places before any concrete is laid, and in proper lengths and widths so as to be embedded in concrete panels 30 feet long by the whole length of the road. The top and bottom bars are held firmly at intervals of 4 feet by an upright steel member, which will make a positively connected unit of the top and bottom bars thru the whole pavement.

Expansion joints ½ inch wide are placed at right angles to the curb line at intervals of 30 feet. Joints have their edges protected by means of a soft steel plate 3/16 inch by 3 inch rolled to conform to the established crown of the pavement and the steel plates are securely attached to the reinforcing bars of the pavement so that the concrete between the expansion joints works as a unit. Expansion joints without steel plates are also placed along the side of the curb ½ inch wide and the whole length of the paved street, the opening extends to the bottom of the concrete base and the space is filled with asphalt filler.

Generally the top bars are 2 feet center to center and those at the bottom 4 feet center to center, but this may vary according to climatic conditions. The vertical supports or stools are made of light angle iron sheared at the bottom so as to bend the feet, "A" "A" (see figure 1), which give a bearing on the grade surface of the road. It will be readily seen, looking at the perspective drawing of the stools, marked "S," that the two parallel sets or horizontal bars are placed transversely and longitudinally (marked "C" "C" and "D" "D") and firmly attached to the vertical support "S" (or stool) by the simple device marked "B," which clinches the bars when engaged in the support "S" or stool.

If expansion joints are used every 30 feet and the street is 24 feet wide, the fixity of these stools, which are generally placed 4 feet on centers, makes a large stone 24 feet wide by 30 feet long, composed of small stones 4 feet by 4 feet, without any joint between the small stones.

Figures 2 and 3 show the only way an expansion joint can be connected permanently with the steel bars in the mass of the pavement—for the whole structure and all its parts must work as a unit. This way of constructing an expansion joint will prevent any possible crack that might occur in the concrete between the reinforcing bars and the plate of the expansion joint.



REINFORCING CONCRETE PAVEMENTS.
Details of Reinforcement.

The Turbine System of Sewer Cleaning

The accompanying photograph shows over two hundred and fifty feet of roots taken out of one block of sewer by the turbine machine at Salt Lake City, Utah, on July 30th of this year. Some of the roots shown are over 22 feet in length. The machine referred to is a water turbine, constructed by the Turbine Sewer Machine Renovating Company, of Milwaukee, Wis.

This turbine is encased in a brass tube

20 inches long, to which is attached a fire hose. The water revolves the cutting blades of the turbine at about the same velocity as an electric fan, cutting and grinding everything to a grout. The displaced matter is carried on down to the

TURBINE SYSTEM OF SEWER CLEANING.
Over 250 Feet of Roots Taken from One Block of Sewers.

outlet with the force of the water. This machine is pulled thru the sewer by a compound geared windlass. A cable is attached to the front end and another is put on the rear end of the machine. On the rear cable a system of clamps around the hose connections takes the strain off the hose. This rear cable also pulls the hose out of the sewer by means of the rear windlass. In connection with this is a forcing jack used to force the machine thru the sewer where the sewer is stopped up.

When the sewer pipe is so completely stopped up it is impossible to run cord or cable thru it, the machine is inserted into the manhole at the low end of the sewer, attached to the hose and water plug, and with the water pressure the machine is allowed to work for a few minutes, in this manner cutting the matter ahead of the machine. The machine under these conditions is connected with the turbine special coupling rods and they are attached to the turbine forcing jack, which, by the operating of the handle, forces the machine ahead. The matter cleaned in this way is ground up into a grout and together with the water is allowed to flow back past the machine and is carried away, leaving the sewer in a clean and sanitary condition.

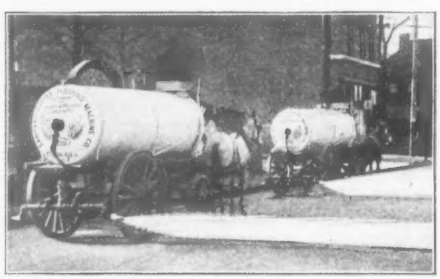
The Sanitary Street Flusher

At the present time there is no one particular subject in municipal government receiving more scientific consideration than that of cleaning paved streets. Too much cannot be said on the subject of sanitation. Tuberculosis, and the whole range of zymotic or filth diseases, are often caused and always aggravated by dirty streets. The dust of the street, moreover, has a strong influence on the general life of the city.

The illustration on this page shows two machines of sanitary automatic type of street flusher in operation on the streets of St. Louis. These machines drive the heavy accumulation of dirt into the gutter, from whence the light portion is taken into solution and carried off by the water, the heavy part precipitates into the gutter, after which it is loaded into carts for removal.

The machines are all built of one size. The tank is made of the best boiler steel, and is so constructed that the necessary air pressure is automatically obtained from the fire hydrants when filling with water. No auxiliary machinery, such as engine, pump or air compressor is required; the pressure of the city water mains does the entire work. The outlet valve is controlled by lever at driver's seat, adjusted so that the operator has perfect control over water issuing from the flushing nozzle when in use. Sarven patent type wheels are used, 2½-inch axles, springs are of special design, tubular steel doubletrees; all valves are made of brass. Its compact and symmetrical construction insures lightness of draft.

These machines are made by the Sanitary Street Flushing Machine Co., of St.



THE SANITARY STREET FLUSHER.
Wagons in Service.

Louis, Mo., and are used quite extensively by such cities as Los Angeles, San Francisco, Denver, Washington, Chicago, Des Moines, Kansas City, Louisville, New Orleans, Detroit, Duluth, St. Louis, Butte, Omaha, Rochester, Cleveland, Cincinnati, Philadelphia, Dallas, Salt Lake City, Seattle, Spokane, etc.

Preparing Asphaltic Concrete

BY H. S. ROGERS, SUPERINTENDENT ASPHALT PAVING PLANTS OF SOUTH PARK DISTRICT, CHICAGO.

The ingredients of the aggregate for asphaltic concrete must be thoroly mixed, to furnish uniformly a minimum percentage of voids. The aggregate must be entirely dry, to be rid of one of the greatest enemies of pavements, moisture. The aggregate must be uniformly heated, to drive off the moisture, and to avoid chilling the binder. The binder (whose melting point is high enough to furnish a firm and impervious cement to stand all weather conditions) must be heated to a perfectly liquid state in a receptacle whose temperature is entirely under control, to avoid waste and ruin, which comes from "flashing" or "burning."

The exact proportions of the aggregate and binder to produce best results must be rigidly maintained by accurate measuring devices. The aggregate and binder must be thoroly mixed.

The mixing should be done in individual batches, to secure uniformity. Economy requires that the succession of the delivery of these batches shall be so frequent and regular as to form a practically continuous operation, which will keep all the men profitably busy all the time.

We use Twentieth Century Portable Asphalt Paving Plants in our work and are, at present, using three of these machines at Forty-seventh and Grand avenues. We can move and set up in ten minutes' time. Our machines are complete, self-contained plants mounted on broad tired wheels. They are operated on the street where the paving is to be done, and are moved forward from time to time as the work progresses. All the working parts are driven from a main shaft receiving power by belt from a traction engine which accompanies the machine at all times and is used in moving forward at intervals.

We use two sizes of these machines, their rated capacities being 800 and 500 square yards of 2-inch thick asphaltic concrete pavement per day of nine hours. These capacities are guaranteed under normally favorable conditions, and will usually be exceeded in actual practice. Under able management of the work and with advantageous conditions, the large machines will lay 1,000 to 1,200 square yards per day.

PREPARING ASPHALTIC CONCRETE.
Laying Asphaltic Concrete of Grand Avenue, Chicago.

The stone and sand are hauled separately to the streets ahead of the machine, there to be mixed in proper proportions and heaped in piles at the machine settings. Shoveled into a hopper at the front, the mixture is fed by spiral conveyor into horizontal revolving drum

dryer, directly over the furnace, the materials being thoroly mixed as they pass slowly toward the rear and where, at a proper temperature, they trail out into the boot of the elevator which delivers them to a storage hopper at the top and rear of the machine.

Beneath the storage hopper is a measuring hopper, the discharge gates of both being operated by levers so interlocked that only one can be opened at a time. The measuring devices for materials are exact, and when the proportions are determined, each batch must come out exactly as wanted. The operator cannot vary the proportions by carelessness or intent.

THE ATLANTIC PUMPING ENGINE.

The Atlantic Diaphragm Pumping Engine

Contractors often look upon labor saving equipment as expensive in first cost or high in maintenance cost so that the possible saving claimed by the manufacturers seldom works out in actual practice. In the case of the Atlantic Diaphragm Pumping Engine, manufacturer by Harold L. Bond Company, 383 M. Atlantic avenue, Boston, and 78 M. Beach street, New York. In a pamphlet recently issued by the manufacturer it is shown by actual figures that this equipment, costing less than $200 and requiring an operating expense of only about 25 cents per day, is capable of affecting an actual saving in labor of more than $13 per day. It is shown that the equipment pays for itself in about two weeks.

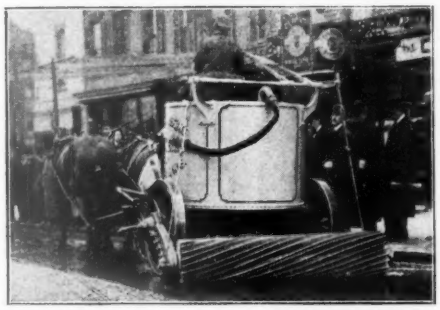
The Atlantic diaphragm pumping engine is designed for use in trench, foundation and other classes of excavation work, where water is not only expensive to handle by ordinary methods, but is frequently responsible for expensive delays.

The outfit consists of a gasoline motor, direct connected to a diaphragm pump, all mounted on a channel iron frame with low cast iron wheels and swivel front axle and drawing handles. The engine is 3½-inch stroke, normal speed 500 revolutions per minute. Speed may be changed while in operation from 300 to 700 r. p. m. without injury to any of its parts. This gives a speed to the pump from 30 to 50 strokes, as may be desired. Capacity, 3,500 gallons per minute. Fly wheel is 14 inches in diameter. Jump spark ignition. Lunkenheimer special generator valve. Ratio of back gear crank to engine shaft, 13½ to 1. All gears have cut teeth. Pinion of steel. Cylinder is cast in form of a sleeve, properly bored inside and machined outside, thus providing cylinder walls of uniform thickness. The water jacket and cylinder construction make the engine absolutely frost-proof, and no serious damage can follow, even tho water was allowed to freeze solid in the water jacket. The engine is provided with a special and original speed regulating device which operates on the governor by increasing the tension on the spring on the governor weight, and at the same time advancing the timing of the spark.

The pamphlet above referred to gives full information as to prices, construction and operation.

The "Squeegee" in New York.

It is safe to say that 95 per cent of the cities and towns of this country are behind the times in the matter of street cleaning. About as far as most of them get in summer is to keep the dust wet down so it does not blow; nevertheless, it tracks into buildings, stores and offices.



THE SQUEEGEE STREET CLEANER.
The Machine in Action in New York.

"In 1910 we made a complete test of the squeegee machine, under the various conditions in this city," states Wm. H. Edwards, Commissioner of Street Cleaning, New York City, "and found that in the congested districts where the conditions are particularly foul, it was able to do 21,247 square yards per machine per day and with the use of 404 gallons of water per 1,000 square yards and in the residence district and under excellent conditions, it did 75,161 square yards per machine per day with the use of 91 gallons of water per 1,000 square yards. In all during the test we found that the average day's work, taking into consideration all classes of neighborhoods, the machine averaged 51,977 square yards per machine per day with the average use of 148 gallons of water per 1,000 square yards. The result of our test convinced me that this machine was a valuable one to be used in the city's work and we are now operating a number of them.

"These machines wash and clean at the same time and are most successful on brick, asphalt and wood block pavements. They are of great service in removing oil and grease from the streets and the cost of operation is exceedingly low."

The machine consists of a four-wheeled gear with platform springs on front wheels. It can be arranged with pole for two-horse team or shafts for three-horse team. A heavy sheet iron circular shaped tank is mounted on springs on rear axle, with front of tank resting on the springs of the front axle. A suitable driver's seat is placed upon top of the tank.

Directly back of the rear wheels and suspended from and at an angle to the rear axle is a spiral revolving rubber brush. This brush can be removed from the surface by the driver from the seat. The two levers for the center sprinklers are on the right side of the driver, and the side sprinklers are operated by the foot levers, one on the right and the other on the left.

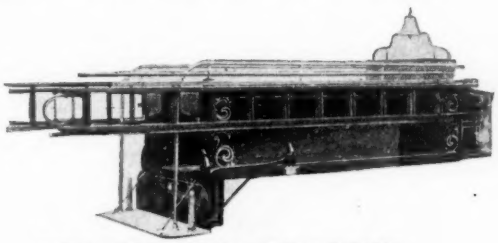
The machine is manufactured by the Kindling Machinery Co.,, 348 Broadway, Milwaukee, Wis.

Fire Equipment to Fit Chassis

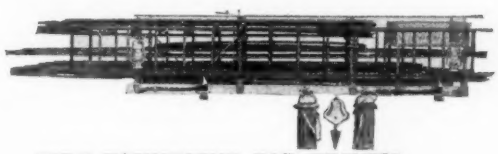
The accompanying illustrations represent equipment for motor fire apparatus, all ready to attach to the chassis.

One illustration shows a hook and ladder truck and the other a combination chemical hose and squad wagon. Both of these types are built in all sizes and can be built to fit any chassis. They are all ready to attach to chassis and all that is necessary is the drilling of a few holes in the chassis frame and bolting the equipment on and they are ready for service.

This makes it a very simple matter for any manufacturer of motor vehicles to build a motor propelled fire wagon, as they will not be bothered with the fire equipment end of it. Peter Pirsch & Company, of Kenosha, Wis., are now making



FIRE EQUIPMENT FOR TRUCKS.
Hose Car Equipment.



FIRE EQUIPMENT FOR TRUCKS.
Ladder Truck Equipment.

a specialty of the building of these equipments to fit any chassis. This will also help to reduce the cost of motor apparatus to the city itself, to a considerable extent, as they can now buy a suitable chassis for this purpose and then get the equipment from this firm and a local man can do the rest.

Collapsible Steel Culvert Forms

The accompanying photographs show a culvert constructed on the German, or Deitz road, near Rice Lake, Wis. This culvert was constructed over a Fife-Coleman collapsible steel form having a 48-inch arch, side walls 16 inches high and a length of 20 feet.

Following is the cost of constructing this culvert:

Hauling 10 cu. yds. sand	$ 6.00
Hauling 4 cu. yds. small field rocks.	1.50
Hauling forms and cement	2.00
7½ bbls. cement, @ $1.35	10.12
9½ days labor, @ $1.75	16.62
Total	$36.24

These forms are made of 16-gage steel covering, reinforced by steel on the inside. The forms are constructed in three pieces, the top (which is semi-circular) and two side plates. The working parts of the form are very simple and easy to operate. The top, setting between the two side plates, is held in position by arms attached to the side plates by bolts which allow the arms to be lowered by pulling the draw rods which are attached to them. By pulling the draw rods the arms are lowered and the support of the top is removed allowing the top to be lowered. The side plates are held in position by swinging braces, so that when the top is drawn the swinging braces are then unlocked and the side plates are easily removed.
locked, the sides are immovable. End plates are made which fasten to the top and side plates by keys so that they may be easily removed.

The first operation in the building of a

COLLAPSIBLE CULVERT FORMS.
Completed Culvert After Removal of Forms.

culvert is the digging of a trench; this, if in hard earth such as clay soil, will not need boarding up, while in sandy soil planking must be used. The trench should be dug at least 4 inches deeper than the water level and this filled with grout and packed down. The width of the trench will depend upon the size of culvert form used and the thickness of the side walls should be 8 to 10 inches. The forms are then erected in the center of the trench, with the end plates on, and covered with grout. The grout extending to the top of the end plates will give a smooth face at each end of culvert over which the dirt from the roadway will not sift and stop the flow of water. This face or abutment also prevents water from washing around sides of culvert, as the face extends 10 or 12 inches beyond culvert walls. After

COLLAPSIBLE CULVERT FORMS.
Forms in Place.

When the width of the highway or the roadbed demands a longer culvert it can easily be made by resetting forms at the end of the finished culvert and repeating the process heretofore described. Where there is a large water supply and low roadbed to contend with, a double culvert may be placed. This is built in the following manner: The first culvert is built in a manner described before and a trench is then dug along this culvert laying bare one side wall. The forms are again reset against this and covered with grout. This gives a center pier and saves one side wall. This operation may be repeated any number of times, giving a series of culverts.

The Fife-Coleman collapsible steel culvert forms are manufactured under patents owned by the Concrete Form & Engine Company, of Detroit, Mich.

All Steel Dump Wagons

The accompanying views of the MacKinnon Steel King Dump Wagon illustrate three sides of the type of wagon which is being used very extensively for hauling asphalt, etc., for paving purposes.

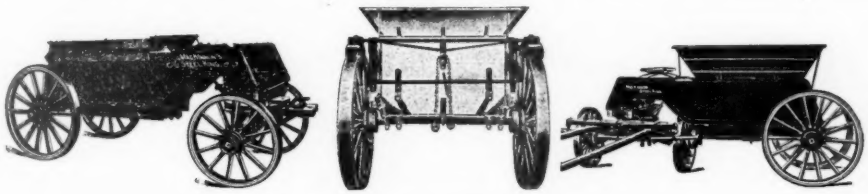
These wagons are furnished with wheels made with the MacKinnon metal covered hub. This hub, being entirely covered by malleable iron, which also projects up the sides of the spokes, will last for years and will withstand the severest strains and wear and cannot be in-

jured by exposure to weather. The wagon being made entirely of steel and with this hub is practically indestructible.

The axle is wood combined with iron—the iron made in the shape of an I-beam strengthened by wood on either side. This method of making an axle was found to support a greater weight than any wood axle that could be employed.

This dump wagon is especially suited to the use of contractors—municipal, garbage, ashes, concrete, sand, gravel, asphalt, etc. It has an all-steel box, that is made light enough to keep the weight down to that of the best wooden dump wagon, but it is at the same time reinforced and braced in the gooseneck, also trussed in the bottom grates. The flare sides are braced at four corners, and in the 3-yard wagon, have an additional angle iron riveted across the center of the flare sides to stiffen and give additional strength.

The driver simply pushes the lever with his foot to dump a load of material. The gates at the bottom dump are made in pairs, two gates on each side which open in the center and swing one behind the other right and left, so that when full open they are 18 inches in the narrow track and 14 inches in the wide track clear of the ground. The gates are closed by a lever. The driver has no occasion to leave his seat. Wagons are arranged so that a three-horse hitch can be attached to any wagon.



ALL STEEL DUMP WAGONS.
Three Views of the Wagon, Showing Details of Construction.

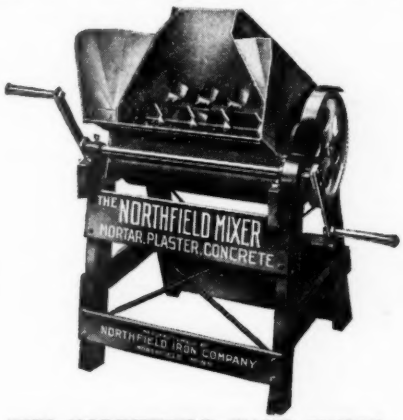
The Northfield Hand Mixer

The Northfield Iron Co., 422 Water street, Northfield, Minn., has placed on the market a hand concrete mixer which promises to be of great service to the small contractor. It is built on an entirely new principle. Three mixing bars are bolted adjustably to the mixing shaft, and seventeen mixing blades or paddles are in turn bolted to these bars, after the manner of the shovels on gang plows. These mixing bars and attached blades are revolved about a central shaft, within

The mixer is guaranteed (under favorable conditions) to give a yardage equal a drum, by a crank driven gear system. Three turns of the crank makes one complete turn of the mixing arms; and requires less than three seconds. This means that the three mixing arms and the seventeen paddles pass thru the mixture every three seconds.

The mixer is guaranteed, under favorable conditions, to give a yardage equal to the following table.

The minimum yardage is based on batches charged with 3-foot barrows and the maximum yardage is based on batches charged with 4-foot barrows, and assuming that conditions are so favorable that each wheeler can load and



THE NORTHFIELD HAND MIXER.

wheel up and dump his barrow into the mixer drum every two minutes, and that these laborers be paid 25 cents per hour for a ten-hour day; batches to be discharged directly into forms:

Size of Crew	Average time per batch	Average cu. yds. per day	Average cost per cu. yd.
2	3 min.	20 to 27 yds.	25 to 18¼ cts.
3	2¼ min.	30 to 40 yds.	25 to 18½ cts.
4	1½ min.	45 to 60 yds.	22 to 17 cts.
5	1 min.	67 to 90 yds.	19 to 41 cts.

IMPROVEMENT AND CONTRACTING NEWS

ROADS AND PAVEMENTS.

BIDS REQUESTED.

Bedford, Ind.—Nov. 5, 1 p. m. Constructing the Bedford-Bloomington gravel road. Ezra W. Edwards, auditor.

Corydon, Ind.—Nov. 6, 2 p. m. Constructing two gravel roads. Wm. Taylor, auditor.

Crown Point, Ind.—Nov. 7, 12 m. Constructing two gravel roads. Chas. A. Johnson, auditor.

Hartford City, Ind.—Nov. 4, 2 p. m. Constructing a macadam road. James A. Cronin, Jr., auditor Blackford county.

Huntington, Ind.—Nov. 4. Constructing the Geo. W. Young road. Harold Guthrie, auditor.

Indianapolis, Ind.—Nov. 12, 10 a. m. Constructing a gravel road. W. T. Patten, auditor Marion county.

Logansport, Ind.—Nov. 6, 10 a. m. Constructing three macadam roads. J. E. Wallace, auditor Cass county.

Marion, Ind.—Nov. 6, 2 p. m. Constructing several gravel roads. E. H. Kimball, auditor.

Peru, Ind.—Nov. 7, 12 m. Constructing a gravel road. Frank K. McElheny, auditor.

Richmond, Ind.—Nov. 4, 11 a. m. Constructing a gravel road. Lewis S. Bowman, auditor.

Shelbyville, Ind.—Nov. 4, 11 a. m. Constructing a road in Moral township. Frank W. Fagel, auditor.

Tipton, Ind.—Nov. 4, 10:30 a. m. Constructing a gravel road. J. H. Tranbarger, auditor.

Cincinnati, O.—Nov. 8, 12 m. Constructing a retaining wall on Indian Hill avenue, under Specification No. 402. Certified check, $500. Albert Reinhardt, clerk, board of Hamilton county commissioners.

Houston, Tex.—Nov. 11, 12 m. Grading and paving the following streets: Austin street, bitulithic pavement on 5-inch concrete; Fannin street, creosoted wood blocks on 5-inch concrete; Lamar street, creosoted wood blocks on 5-inch concrete. Certified check, 5 per cent on each bid. H. B. Rice, mayor.

CONTRACTS AWARDED.

San Bernardino, Cal.—Paving B street, to the Highway Construction Co., $13,962.

Galesburg, Ill.—Paving Ferris street, to J. B. McAuley, $17,798.

Mattoon, Ill.—Constructing paving in the Tenth street district, to Bresee and Brown, $22,643.

Pontiac, Ill.—Paving ten blocks of brick pavement, to Keys & McNamara, $37,000.

Springfield, Ill.—Constructing 1¼ miles of paving, to the J. S. Wood Construction Co., $15,000.

Marion, Ind.—Paving several streets, to the Cleveland Trinidad Paving Co., $22,600.

Baltimore, Md.—Constructing several sewers, to E. F. Sweeten & Son, $160,000.

Grand Rapids, Mich.—Paving South Market street, to Carpenter and Anderson, $39,999.

Laurel, Miss.—Constructing creosoted wooden block paving, to the Southern Paving & Construction Co., Chattanooga, Tenn., $47,793.

Buffalo, N. Y.—Paving Bidwell boulevard, to the German Rock Asphalt Co., $18,890.

Caldwell, O.—Constructing a mile of Sharon road, to Glover and McElfresh, $15,000.

Portsmouth, O.—Paving Home avenue, to Monroe & Son, $12,849.

Salem, O.—Paving the Wellsville-Salineville road, to Patterson & Gasten, Wellsville, $17,740.

Greenburg, Pa.—Constructing the Greenburg-Mutual road, to Rhinehart Brothers, $19,000.

Pittsburgh, Pa.—Constructing the Glassport and Elizabeth extension road, to John Connelly, $20,203; constructing one mile of the Chartiers road, to A. Ancomi, $14,101.

Salt Lake City, Utah.—Paving Second street with asphalt, to G. A. Heman, St. Louis, $21,504.

Bellingham, Wash.—Paving Elk street, to C. G. Burnett, $18,372.

Wheeling, W. Va.—Constructing a river road from Warwood to Short creek, 4.3 miles, to R. L. McNabb, Wellsburg, $23,000.

CONTEMPLATED WORK.

Los Gatos, Cal.—A $35,000 bond issue for street improvement has been voted. A. E. Winning, city clerk.

Waycross, Ga.—A $100,000 bond issue for public improvement of streets, fire department and water works has been voted. Mayor Reed.

South Haven, Mich.—A $25,000 bond issue for road improvement has been voted. Geo. W. Matthews, township clerk.

Hilton, N. J.—A $23,000 and a $10,000 bond issue for park improvement has been voted.

Trenton, N. J.—A $15,000 bond issue for road improvement has been voted.

Dansville, N. Y.—A $43,400 bond issue for street paving has been voted. Harry Rowan, city clerk.

Wappingers Falls, N. Y.—A $12,000 bond issue for road improvement has been voted.

Cleveland, O.—A $225,000 bond issue for park improvement has been voted. W. J. Springborn, director of public works.

Hamilton, O.—A $25,000 bond issue for street improvement has been authorized.

Martins Ferry, O.—A $12,000 bond issue for park improvement has been voted.

Cleveland, O.—A $500,000 bond issue for street and sewer improvement has been voted, W. J. Springborn, director of public service.

Norman, Okla.—The construction of a city park is contemplated.

Philidelphia, Pa.—A $600.000 bond issue for park and playground improvement has been authorized.

Philadelphia, Pa.—A $500,000 bond issue for resurfacing asphalt streets has been authorized.

Philadelphia, Pa.—A $300,000 bond issue for road improvement and a $200,000 bond issue for street repair have been authorized.

Susquehanna, Pa.—A $15,000 bond issue for street paving has been voted. D. J. Lynch, boro secretary.

Devine, Tex.—A $40,000 bond issue for road improvement has been voted.

Fairmount, W. Va.—A $400,000 bond issue for Marion county roads has been voted. John T. Phillips, county clerk.

SEWERS.

BIDS REQUESTED.

Clinton, Ia.—Jan. 15, 1913. Constructing a new system of city sewers. Iowa Engr. Co., engineers.

Houston, Tex.—Nov. 11, 12 m. Constructing sanitary sewers in the Second ward, including about 37,900 lin. ft. of sewer pipe and appurtenances. Certified check, $6,800. H. R. Rice, mayor.

Laredo, Tamaulipas, Mexico—Nov. 14. Constructing complete sanitary sewer system, including 10,000 lin. meters of sewer pipe. Plans and specifications can be obtained of "Municipal Engineering," Editorial Dept., Indianapolis, Ind. M. Rodrigues, mayor.

Installing gas engines complete in sewer

Larendo, Tamaulipas, Mexico—Nov. 14. system and water supply plant. Plans and specifications can be obtained at the Editorial Dept. of "Municipal Engineering," Indianapolis Ind.

CONTRACTS AWARDED.

San Bernardino, Cal.—Constructing a sewer on I street, to Chas. McElvaine, $11,050.

Gary, Ind.—Constructing sewers in District No. 11, to the Cain Construction Co., $10,671.

Harper, Mo.—Constructing a sewer system, to Bash & Gery, Joplin, Mo., $22,085.

Jefferson City, Mo.—Constructing several sewers, to Joseph Pope, $11,354.

Kansas City, Mo.—Constructing a large sewer, to W. W. Cook & Son, Junction City, $95,078.

Springfield, Mo.—Constructing sewer extensions, to Plummer Construction Co., $55,-601.

Urbana, O.—Constructing a sewer system, to Boyd & Cook, Dayton, $110,000.

Pittsburgh, Pa.—Constructing a relief sewer on Thirty-third street, to John F. Casey Co., $109,359.

CONTEMPLATED WORK.

Russellville, Ark.—Will advertise for bids for construction of city sewers. Estimated cost, $28,000. Street commissioners.

Fowler, Cal.—A $20,000 bond issue for sewer improvement has been voted. M. H. Minier, city clerk.

Los Gatos, Cal.—A $300,000 bond issue for sewers has been voted.

Lawrenceville, Ga.—A $15,000 bond issue for sewers has been voted. J. H. Britt, city clerk.

Kingsley, Ia.— A $12,000 bond issue for sewer construction has been voted. Rey E. Rieke, city recorder.

West Point, Nebr.—A $14,000 bond issue for sewer extensions has been voted. Augusta Hanft, city clerk.

Cleveland, O.—A $200,000 sewage disposal plant is contemplated at Newburg Heights.

Cleveland, O.—A $500,000 bond issue for street and sewer improvement has been voted. W. J. Springborn, director of public works.

Portland, Ore.—The construction of sewer extensions in East Glisan street, to cost about $154,299, is contemplated.

Philadelphia, Pa.—An $800,000 bond issue for main and branch sewers has been authorized.

Clarksburg, W. Va.—A $22,000 bond issue for water works and sewers has been voted. M. E. Henderson, mayor.

Bangor, Wis.—A $14,000 bond issue for sewer system has been voted.

WATER WORKS.

BIDS REQUESTED.

Laredo, Tamaulipas, Mexico—Nov. 14. Erecting water supply plant complete, including 18,283 lin. meters of cast iron water pipe. Plans and specifications can be obtained of the Editorial Dept., "Municipal Engineering," Indianapolis, Ind. M. Rodriguez, mayor.

Laredo, Tamaulipas, Mexico—Nov. 14. Installing centrifugal pumps in water supply plant. Plans and specifications can be obtained of the Editorial Dept., of "Municipal Engineering," Indianapolis. M. Rodrignez, mayor.

Laredo, Tamaulipas, Mexico—Nov. 14. Constructing two reinforced concrete tanks and an elevated steel tank. Plans and specifications can be obtained at the Editorial Dept. of "Municipal Engineering," Indianapolis. M. Rodrignez, mayor.

CONTRACTS AWARDED.

Logan Ia.—Constructing improvements to the water works system, to the Des Moines Bridge & Iron Co., $17,100.

CONTEMPLATED WORK.

Fowler, Cal.—A $25,000 bond issue for water works improvement has been voted. M. H. Minier, city clerk.

Tulare, Cal.—A $100,000 bond issue for water works system has been voted.

Ocala, Fla.—A $100,000 bond issue for water works has been voted.

Byronville, Ga.—A $10,000 bond issue for water works construction has been voted.

Waycross, Ga.—A $100,000 bond issue for public improvement of streets, fire department and water works has been voted. Mayor Reed.

Marshalltown, Ia.—A $15,000 bond issue for an electric light plant has been voted.

Redfield, Ia.—A $15,000 bond issue for an electric light and water works improvement has been voted.

Saline, Mich.—A $30,000 bond issue for water works system has been voted.

Chester, Mont.—A $22,000 bond issue for water works has been voted.

Doniphan, Mo.—An $18,000 bond issue for water and light plant extensions has been voted.

Greenfield, Mo.—A $16,500 bond issue for water works has been voted. L. A. Wetz, city clerk.

New Brunswick, N. J.—A $135,000 bond issue for a filtration plant has been authorized.

Jamestown, N. Y.—A $150,000 bond issue for water works extensions has been passed. Clement B. Jones, city clerk.

Enderlin, N. D.—A $10,000 bond issue for water works has been voted.

Lima, O.—A $100,000 bond issue for water works extensions has been voted.

Springfield, O.—A $170,000 bond issue for the construction of a reinforced water works main has been authorized.

Zanesville, O.—The construction of a $361,-000 filtration plant is contemplated.

Philadelphia, Pa.—A $300,000 bond issue for water supply in West Philadelphia has been authorized.

Hurley, S. D.—A $16,000 bond issue for water works has been voted.

Clarksburg, W. Va.—A $22,000 bond issue for water works and sewers has been voted. M. E. Henderson, mayor.

Burlington, Wis.—A $15,000 bond issue for water works improvement has been voted.

Waterford, Wis.—A $15,000 bond issue for water works system has been voted.

BRIDGES.

BIDS REQUESTED.

Eutaw, Ala.—Nov. 6, 11 a. m. Constructing six steel bridges. Certified check, $400 on each bid. W. S. Keller, state highway engineer.

Chandler, Okla.—Nov. 8, 2 p. m. Constructing two steel and concrete bridges. Certified check, 10 per cent. J. E. Rea, county clerk.

Huntsville, Tex.—Nov. 11. Constructing two steel bridges. A. T. Randolph, county clerk.

CONTRACTS AWARDED.

Rush, N. Y.—Constructing a bridge across the Genesee river, to the Owego Bridge Co., $22,000.

Brigham City, Utah.—Constructing twelve bridges, to the Omaha Structural Works of Omaha, $29,000.

CONTEMPLATED WORK.

San Francisco, Cal.—Will build a steel bridge across Suisun Bay. Estimated cost, $1,650,000.

Lewiston, Ida.—A $35,000 bond issue for bridge construction has been voted. C. F. Leland, city clerk.

Trenton, N. J.—A $13,000 bond issue for bridge improvement has been voted.

Brooklyn, N. Y.—The construction of a $500,000 bridge in Twenty-fifth street is contemplated. Frand Lander, county commissioner.

Hamilton, O.—A $12,000 bond issue for bridges has been authorized.

Philadelphia, Pa.—A $200,000 bond issue for bridges has been authorized.

Fort Worth, Tex.—A $600,000 bond issue for bridge construction has been voted.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

CONTEMPLATED WORK.

Cleveland, O.—A $50,000 bond issue for a garbage plant has been voted. W. J. Springborn, director of public works.

STREET LIGHTING.

CONTEMPLATED WORK.

Avilla, Ind.—The installation of an electric light plant is contemplated.

Marshalltown, Ia.—A $15,000 bond issue for an electric light and water plant has been voted.

Redfield, Ia.—A $15,000 bond issue for an electric light plant and water works improvement has been voted.

Clara City, Minn.—A $5,000 bond issue for electric light plant construction has been voted.

Doniphan, Mo.—An $18,000 bond issue for water and light plant extensions has been voted.

Binghamton, N. Y.—Will order twenty-one boulevard standards for the court house square. Supervisor Kilmer.

Canistota, S. D.—The installation of an electric lighting system is contemplated.

FIRE APPARATUS.

CONTEMPLATED WORK.

Fort Smith, Ark.—A $12,000 appropriation for an aerial auto has been made.

Little Rock, Ark.—Purchase of a motor car, to cost about $2,000, for the fire chief, is contemplated.

Tulare, Cal.—An $8,000 bond issue for fire apparatus has been voted.

Americus, Ga.—The purchase of motor road machinery is contemplated by the board of county commissioners. A. F. Hodges, commissioner.

Atlanta, Ga.—The city will purchase five or six auto fire apparatus immediately. The autos are to cost about $10,000.

Waycross, Ga.—A $100,000 bond issue for public improvement of streets, fire department and water works has been voted. Mayor Reed.

Springfield, Ill.—The purchase of a seven passenger auto for the police department is contemplated.

Atlantic City, N. J.—The purchase of four autos for use of city officials is contemplated. Commissioner Bacharach.

Cleveland, O.—A $75,000 bond issue for auto fire apparatus has been voted. W. J. Springborn, director of public works.

Cleveland, O.—The purchase of nine autos for battalion chiefs and three auto tractors for ladder trucks and water tower and four new engines is contemplated. Fire Chief Wallace.

East Liverpool, O.—The city council is contemplating the question of completely motorizing the fire department.

Harrisburgh, Pa.—The purchase of an auto for the park commission is contemplated.

Pittsburgh, Pa.—The purchase of motor fire apparatus is contemplated. Wm. A. Magee, mayor.